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Mercator's Map of the World, 1538. Facsimile in black-and-white, reproduced from the original in the Society's collection (only two original copies of this map are known). 1885.

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OUR CONTRIBUTORS

Mr. Van Cleef has been for seven years professor of geography at the State Normal School, Duluth, Minn. He has specialized mainly in climatology and the application of geography to business. His principal publications include: Climatic Influences on the Economic Development of Australia (*Bull. Geogr. Soc., Philadelphia*, Vol. 8, No. 4, 1910); A Geographic Study of Duluth (*Bull. Amer. Geogr. Soc.*, Vol. 47, April-May, 1915); The Sugar Beet in Germany, with Special Attention to Its Relation to Climate, *ibid.*, Vol. 44, June-July, 1912); A Rainfall (Wall) Map of the United States (Rand, McNally & Co., 1916).

Dr. Porsild, who is well known as an authority on Arctic botany, has been Director of the Danish Arctic Station at Disko, Greenland, since its foundation in 1906. Dr. Porsild has taken advantage of his rare opportunities to engage in the study of Eskimo culture and he has contributed several interesting and valuable papers on this subject to the *Meddelelser om Grønland*.

Mr. McBride is assistant editor on the *Geographical Review*.

Professor Jefferson is professor of geography at the State Normal College, Ypsilanti, Michigan. His studies deal especially with human geography, particularly with the distribution of population. Among his numerous papers and publications may be mentioned: The Anthropography of Some Great Cities (*Bull. Amer. Geogr. Soc.*, Vol. 41, 1909); The Culture of the Nations (*ibid.*, Vol. 43, 1911); Utah, The Oasis at the Foot of the Wasatch (*Geogr. Rev.*, May, 1916); The Distribution of British Cities, and the Empire (*ibid.*, Nov., 1917); The Rainfall of Java (*ibid.*, June, 1918); Teachers' Geography; Man and Climate (1911); Notes on the Geography of Europe (1917).

Mr. Wallis is an authority on the teaching of geography, on which subject he published an important book in 1915. His attention was more especially directed to Austria-Hungary while assisting in the compilation of the Royal Geographical Society's emergency war map of Europe, on which occasion the sheets covering this country were allotted to him. In this connection he discussed a new method of mapping density of population and distribution of nationalities (*Geographical Journal*, March, 1916). Articles on the Danube Monarchy by Mr. Wallis that have appeared in the *Review* are: one on Hungary in December, 1917, one on Austria in July, 1918, and in August, the first of a series on Nationalities in Hungary. Others of his papers deal with the rainfall of the United States and (in the January, 1917, *Review*) the industrial geography of central England.

ARTICLES ON THE GEOGRAPHY OF THE WAR

published in the Geographical Review

The Great Russian Retreat. By D. W. JOHNSON. (25 pp.; with 6 maps and 6 photographs.) . . . . February, 1916.

The Balkan Campaign. By D. W. JOHNSON. (21 pp.; with 1 map and 4 photographs.) . . . . . July, 1916.

The Conquest of Rumania. By D. W. JOHNSON. (19 pp.; with 1 map and 3 photographs.) . . . . . June, 1917.

In these three articles Professor Johnson discusses the influence of geographical conditions on the military campaigns in the areas affected. The second deals with the campaign against Serbia at the end of 1915. Each article gives an outline of the physical features of the area discussed and is illustrated by maps showing the positions of the battle lines at various critical junctures.

The Military Campaigns Against Germany's African Colonies. By G. M. WRIGLEY. (22 pp.; with 5 maps.)

The more pronounced control of geographic conditions in the African as compared with the European campaigns, because of the larger areas affected and the greater dependency here of man on nature, is clearly brought out in this article. The campaign in each colony is illustrated by a map indicating the troop movements in relation to the topography. The article is accompanied by a full bibliography.

The Rôle of Political Boundaries. By D. W. JOHNSON. (5 pp.) . . . . . September, 1917.

A geographical discussion of the boundary problem, as set forth in several recent articles.

Europe at Turkey's Door. By LEON DOMINIAN. (9 pp.; with 2 maps.) . . . . . April, 1916.

Discusses the claims of the European powers to Turkish territory, based on political and economic grounds. Illustrated by a separate map showing the spheres of influence and territorial claims in Asiatic Turkey of Russia, England, France, Greece, and Italy.

The Geographical Distribution of the Balkan Peoples. By JOVAN CVIJIĆ. (17 pp.; with 1 insert map in color.) . . . . . May, 1918.

An article by the foremost geographer of Serbia. The accompanying colored map shows the distribution of nationalities and creeds in great detail.

The Zones of Civilization of the Balkan Peninsula. By JOVAN CVIJIĆ. (13 pp.; with 1 insert map in color.) . . June, 1918.

Discusses the growth and present distribution (shown on colored map) of the two main forces, Old Balkan (modified Byzantine) civilization and the patriarchal régime, and the subsidiary influences, Turco-Oriental, Italo-Mediterranean, Mediterranean, Central European, Western European.

The Balkans, Macedonia, and the War. By H. CHARLES WOODS. (18 pp.; 1 map and 10 photographs.) . . July 1918.

Albania and the Albanians. By H. CHARLES WOODS. (17 pp.; with 1 map and 8 photographs.) . . . . April, 1918.

Discussions of the politico-geographical problems by a first-hand observer of the country and its people.

(Continued on next page)

Russia's War-Time Outlets to the Sea. (5 pp.; with 1 map.) . . . . . February, 1916.

Deals with the closing of the Baltic and Black Sea outlets to Russia by the war and her circumvention of this obstacle, especially by the construction of a railroad to Kola, an ice-free port on the Arctic Ocean. With map.

Flanders. By RAOUL BLANCHARD. (17 pp.; with 2 maps and 9 photographs.) . . . . . December, 1917.

A summary of the geography, physical and human, of one of the most important battle areas of the present war.

The Peoples of Hungary: Their Work on the Land. By B. C. WALLIS. (17 pp.; with 8 maps.) . . December, 1917.

The Rumanians in Hungary. By B. C. WALLIS. (3 insert maps in color, 1 text map, 2 diagrs.) . . . . August, 1918.

The Peoples of Austria. By B. C. WALLIS. (14 pp.; with 5 insert maps in color.) . . . . . July, 1918.

Discussions of the human geography of the two states, with special attention to the problem of nationalities. Two of the accompanying maps in each article, representing by a new method the population density and distribution of nationalities, are especially valuable.

The Carpathians: Physiographic Features Controlling Human Geography. By EMMANUEL DE MARTONNE. (21 pp.; with 2 text-maps, 1 insert map in color, 3 diagrams, and 10 photographs.) . . . . . June, 1917.

A general account, illustrated by a colored physiographic map, of the interrelations of the physical features and human life, many of which have a bearing on the military operations of the present war in this area.

Poland: The Land and the State. By EUGENIUSZ ROMER. (20 pp.; with 12 maps.) . . . . . July, 1917.

A geographical interpretation of Poland's history and development and an exposition of her essential geographical unity. The article is accompanied by ten black-and-white maps illustrating the racial and territorial development of Poland from 800 to 1795.

The Racial History of the British People. By H. J. FLEURE. (16 pp.; with 2 maps.) . . . . . March, 1918.

A geographical exposition of the early racial movements which led to the settlement of Britain and their reflection in the composition of the present-day population.

Aëronautical Charts. By OMAR B. WHITAKER. (5 pp.; with 2 maps.) . . . . . July, 1917.

Aëronautical Maps and Aërial Transportation. By HENRY WOODHOUSE. (22 pp.; with 4 maps, 3 drawings, and 5 photographs.) . . . . . November, 1917.

European War Maps. By W. L. G. JOERG. (4 pp.) . . July, 1917.

The first two articles discuss a phase of mapping of high importance in the development of the aëroplane. They are illustrated by reproductions of aëronautical maps used in this country and in Europe. The second article also deals with the commercial possibilities of aëronautics in the immediate future. The third article gives a selected list of maps, detailed topographic sheets as well as general maps, of use in following the military operations in Europe.

THE
GEOGRAPHICAL REVIEW

VOL. VI SEPTEMBER, 1918 NO. 3

THE FINN IN AMERICA*

By EUGENE VAN CLEEF

At this time it is perhaps of special interest to know the distribution of Finns in the United States, the extent of the Finnish "invasion" into northeastern Minnesota, the results attained by the Finn in his native land and in his new environment, and the possibilities of the Finn as a citizen of the United States.

Distribution of the Finns in the United States

Although Finns dwell in every state in the Union, their numbers are essentially negligible in all but the states of the northern half of the country. Hence, in the map (Fig. 1) showing the states where 500 or more reside, the southern states remain without a dot. The total number of Finns in the United States, including native and foreign born, was in 1910, 211,026.[1] The estimate for 1917 places their number at close to 300,000.

Michigan and Minnesota stand out preëminently as "Finnish" states. Massachusetts ranks next, the cotton and woolen mills oddly enough retaining a sort of magnetic hold upon the Finns, especially the women. Fitchburg and Worcester are the principal points of concentration. New York State ranks relatively high because of the large number of Finns in New York City. The clothing industry in the country's metropolis induces many of the Finns there to become permanent residents.

The western states, Montana, Oregon, Washington, and California, present a sort of anomaly in the problem. A more detailed consideration will be given later, but here it may be pointed out that the rise of the lumber industry in these states, coupled with its disappearance in the Great Lakes region, has been a potent factor in the western migration of

* Acknowledgment is made to Mr. L. B. Arnold, Land Commissioner, of the Duluth and Iron Range R.R., for his many courtesies which have made possible this investigation; to the Finnish people of Duluth and vicinity who have co-operated so generously; and to Mr. O. J. Larson of Duluth who has made possible the publication of this entire manuscript.

[1] U. S. Census, 1910. Unless otherwise stated, all figures are based on this census.

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many Finns. The fisheries in the Puget Sound District and farming in all the area have had a secondary influence. The greater number of Finns in California are concentrated in San Francisco.

The southern states show a notable absence of Finns. For example, South Carolina has only 38, Florida 137, Georgia 65, Louisiana 186, Texas 218, Arkansas 30, and Kentucky 32.

Absolute numbers, if isolated, may exaggerate their significance; hence Figure 2 is introduced to show the relative number of Finns in each state

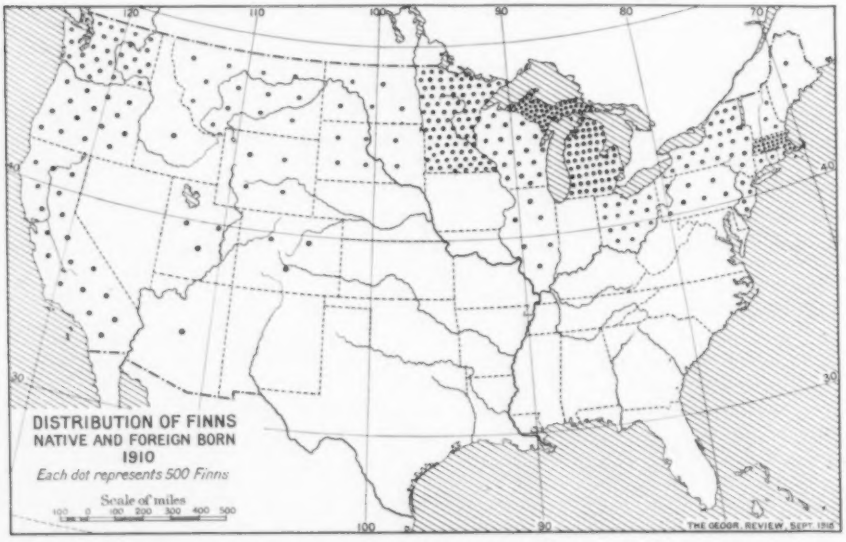
DISTRIBUTION OF FINNS
NATIVE AND FOREIGN BORN
1910
Each dot represents 500 Finns
Scale of miles
100 0 100 200 300 400 500
THE GEOGR. REVIEW, SEPT. 1918

FIG. 1—Cartogram showing distribution of Finns, native and foreign born, by States, 1910. The absence of Finns in the south is in striking contrast with the density in the north. Scale 1:41,000,000.

as compared with the total foreign population. Again the southern states are conspicuous by their lack of a considerable Finnish population. All the western states would seem to have fairly numerous colonies; but when one considers their small total foreign population compared with that of the central and eastern states the seeming discrepancy disappears. For example Wyoming, which shows 3.6 per cent of its total foreign population to be Finns, has a total foreign population of only 59,622, of whom 2,154 are Finns; whereas Ohio, which shows only 0.5 per cent to be Finns, has a total foreign population of 1,621,638, of whom 7,301 are Finns. Probably the most impressive figure on this map is the very low percentage of Finns everywhere, it being nowhere as high as 4 per cent.

URBAN VS. RURAL POPULATION

More than half (54.5 per cent) of the total population of Finns live in the rural[2] districts of the United States. This is rather notable, for only

[2] By "rural" is meant communities of less than 2,500 inhabitants.

immigrants from Norway, Denmark, Luxemburg, and Mexico show a similar tendency. The general inclination for foreigners is to concentrate in urban centers. Less than one-third of all "foreign white stock" (31.8 per cent) is located in the rural districts.

Moreover the proportion of Finns living under essentially rural conditions is higher than the figures show. Fresh immigrants gravitate almost immediately towards the mines and camps. In both instances they headquarter largely in towns of 2,500 or more and hence are enumerated as

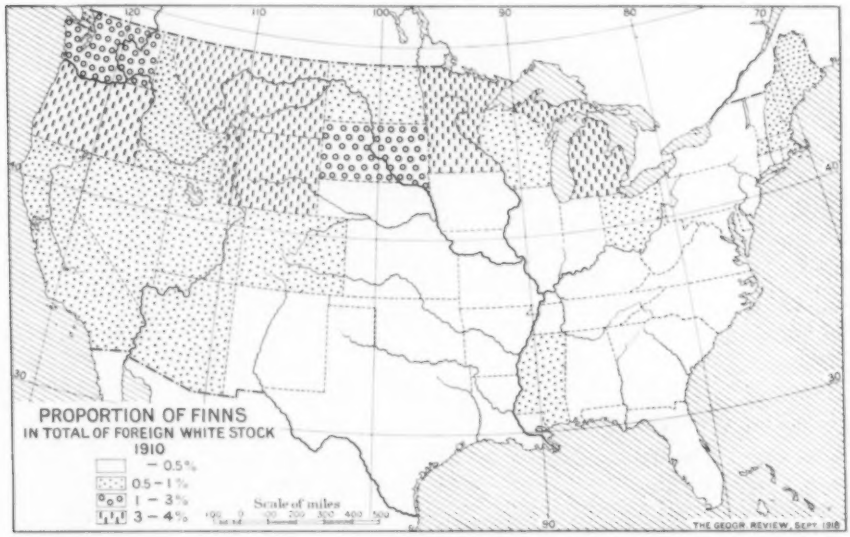

FIG. 2—Cartogram showing percentage of Finns among the total foreign-born white stock, by States, 1910. Relatively as well as absolutely the south shows lack of attraction for Finns. Scale 1:41,000,000.

those residing in urban communities. Otherwise, if the census were taken in their case on the basis of occupation, the per cents would favor the rural districts. The very strong attraction of the out-door life is exhibited also in the case of those who are native-born but of foreign or mixed parentage, among whom the proportion in the rural area reaches the high figure of 61.7 per cent. The Finns, therefore, may be classified as distinctly a rural people.

In 26 states of the Union over 50 per cent of the Finns live in the rural districts. In such states as Illinois and New York, large manufacturing centers attract the relatively small number who happen to reside there, but these constantly drift toward the land. Interviews with many Finns who have passed through the several stages before reaching the farm, reveal the fact that the congested cities retain the Finn a very short time. As soon as he saves enough money to purchase a small acreage or to claim a homestead he establishes communion with nature and leads a life more attractive and more satisfying to his natural and seemingly instinctive desire to live in the open.

Lake Superior District

The vicinity of Lake Superior seems to constitute the haven of refuge for the Finns. Their density is greater here than in any other equal area in the country.[3] Figure 3 represents the distribution about Lake Superior, and at the same time brings to light the apparent attraction of the iron and copper mines. The region is also forested and accordingly attracts the lumberjack. Northeastern Minnesota presents conditions typical of practically the entire Lake Superior district. For this reason, it was chosen as the scene of the present investigation. St. Louis County (see Fig. 3), in Northeastern Minnesota, has been the principal field for intensive study. St. Louis County has an area of 6,503 square miles. Its total population is 163,274, of whom 16,381,[4] or about 10 per cent, are Finns. The Finns are engaged in iron ore mining, lumbering, and agriculture. They number about 10 per cent[5] of the total of foreigners in the mines. The number of men of all nationalities employed in the mines in 1917 was 14,479.[6]

The number engaged in lumbering fluctuates, as most of the Finns in this industry are employed only in winter for logging operations in the woods. Hence employment is generally temporary, and these so-called lumberjacks are oftentimes the miners and farmers of the summer season. A few work in the lumber mills the entire year.

Agricultural pursuits attract most of the remaining Finns. Nearly 60 per cent (or about 1,800) of the farmers of the county are Finns. This number must be multiplied by at least 3 to obtain the total number of Finns on the land, for the families are large. Others are engaged in miscellaneous occupations in the cities. Duluth, the largest city of the county, with a population of 78,466 in 1910, was credited with 2,772 Finns.

The Finns in the Mines

The absence of large mineral deposits in Finland means that few of the natives are miners. Emigration is mainly from the northerly parts of Finland[7] where the population is scattered, and where agriculture, practically the only pursuit, is carried on under severest handicaps.

Singularly enough, the first Finns who settled in the Lake Superior district became miners. They left their homes because of depressing economic conditions and in hope of a better future in America. The gold rush of '49 in California attracted a few, but none of them profited. A little later, between 1850 and 1860, about 250 Finns from the copper

[3] There is a similar distribution in Canada. The census of 1911 gives 4,301 Finns (about 28 per cent of the total in Canada) in the Thunder Bay-Rainy River district at the western end of Lake Superior. Other large groups are found elsewhere in the Lake region.

[4] Census of 1910; the estimate for 1917 places the number at from 20,000 to 25,000.

[5] Estimate of the Oliver Iron Mining Company. Accurate records of nationalities are not kept.

[6] Report of W. H. Harvey, County Mine Inspector, October, 1917.

[7] Ninety per cent of those interviewed came from northern Finland, or, if native-born, their parents came from those parts.

mines of Norway and Sweden arrived at Calumet, Michigan, to help in the newly opened copper mines.[8] This seems to be the only instance of the importation of Finns by an industrial company.

After a short acquaintance with the new land these men wrote home to friends and relatives, sometimes sending transportation tickets, encouraging them to come to this country, where tyranny was unknown and independence was a possibility. The subsequent years, up to the present, have witnessed a steady though not large inflow of their countrymen. The

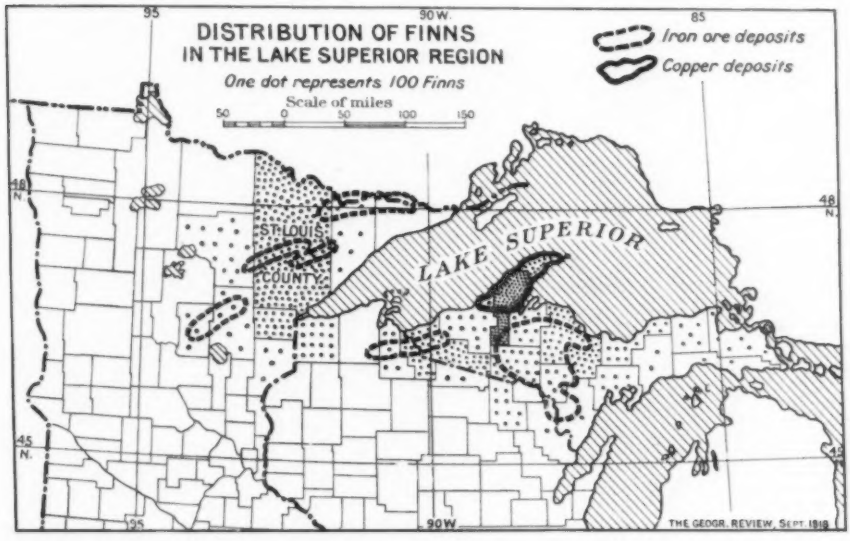

FIG. 3—Cartogram showing distribution of Finns in the Lake Superior Region. This is by far the most attractive region for the Finn in America. Scale 1:9,500,000.

new arrivals could not speak English and had no money. The land was still densely wooded, and the winters were long. Mining was the only occupation open. In the years since the first settlements among the mines of Michigan, successive Finnish immigrants have entered the iron mines of both northern Michigan and northeastern Minnesota. Many who are prominent citizens in these parts today found their opportunity there.

THEIR THRIFT, EFFICIENCY, AND ENDURANCE

But the Finn is not a miner by nature. He is a man of the soil. After working in the mines a few years—the average is from two to five—he uses his savings for the purchase of some land or for taking up a homestead. In some instances, however, after leaving the mines as a place of regular employment, he may return temporarily when in need of money. He is credited with being the most thrifty of all nationalities represented in the mines and lumber camps.

[8] According to C. H. Salminen, manager of *Finnish Daily News*, Duluth, and others.

FIG. 4—Unusually numerous buildings characterize the Finnish farm. The boulder-strewn highland in the background is a familiar feature of the landscape. Embarass, Minn.

In efficiency in the mines the Finns rank close to the top. They make good timbermen in the underground mines, for they are reputed "clever and ingenious with axe and log." Herein one may see the result of their many centuries of training in the forests of their native land. Their struggle with nature has also developed much resourcefulness. The younger Finns coming to this country today show a considerable proficiency along mechanical lines. Some of them are employed in handling drills and other machinery requiring dexterity.

The physical strength of the Finn contributes to his ability to endure the strains incident to mining. The work is hard, and the winter long and rigorous. Where the open pit process is used, employment does not last throughout the year. Hence many workers must find something else to engage them during the closed season. The relative isolation of the region makes travel to other industrial centers rather expensive. Therefore adjustment is made to practically the only alternative, logging. Hundreds of Finns go to the woods to labor in the deep snow and in temperatures ranging from —15° to —30° F. Their life is camp life, but not after their own choosing. It oftentimes is next to intolerable. Yet doggedness, a sense of responsibility, unusual powers of endurance, enable them to remain throughout the season. They have had vigorous training in the "land of a thousand lakes" and the land of as many hardships.

The Finn in Agriculture

Condition of the Land

The Finn has acquired much of his land in northeastern Minnesota as a homesteader, although recently he has become an active purchaser in the open market. His holding ranges from 40 to 160 acres. If he is a homesteader he always possesses the latter amount. For the most part his land is heavily timbered with tall thin spruce and tamarack and the birch with its accompanying underbrush. Occasionally some jack pine is scattered about. More often than not, the desirable timber has been removed by lumber companies before the land is placed on sale, only the stumps remaining; or, if virgin timber be available, it is not in abundance.

The spruce and tamarack land is swampy. It is highland swamp ranging from 1,200 to 2,000 feet above sea level and from 600 to 1,400 feet above Lake Superior. The several moderately sized streams of fair gradient flowing either across the land or near it (Fig. 9) make drainage relatively easy after a clearing has been effected. Oftentimes a few acres, sometimes as much as one-half of a forty-acre tract, consist of swampy land known as "muskeg." The muskeg, which varies in depth from 3 to 21 feet, is a sort of transition swamp verging on the peat stage. This land corresponds almost everywhere to the *Hochmoor* of Germany, Denmark, and Finland. In addition to muskeg there may be a very generous distribution of glacial

boulders of large size (Figs. 4 and 10), especially upon the higher, better drained land most desirable for cultivation.

Humble Beginnings

The Finn builds a little single-room or two-room tar-papered shack (Fig. 5) near an edge of his land where the drainage is good. He will clear about an acre the first summer. When winter interrupts his work he may go to the woods as a lumberjack to earn a little ready money. The next spring he returns to his farm to continue improvements. Should he run short of funds before the following winter he may work for a few weeks as a common laborer on county or town roads. It has been said that the road-building activity of the counties and towns in northeastern Minnesota has been the salvation of the farmer, not merely because it gives him an improved means of communication, but because it gives him employment and funds.

As soon as a few hundred square feet are cleared, potatoes and rutabagas are planted. A cow barn and cow follow. "Where there's a Finn there's a cow" is almost axiomatic. Another year witnesses the addition of a few chickens. Garden, cow, and poultry now assure the pioneer's food supply: he is fairly on the road to independence.

Construction of Buildings

In the evolution of the farm the construction of buildings plays an important part. One may very safely identify a Finnish farm from a distance by its number of buildings (Fig. 4). Among them may be counted the owner's first shack, his later log cabin, his recent modern dwelling (Fig. 7), his never-forgotten bathhouse, a cow barn, perhaps the old one and the new one with its glacial-boulder foundation, a horse barn, a root cellar, several hay barns scattered over the fields, a tool house, a woodshed, and other miscellaneous special buildings.

The hay barn alone is a means of identifying a Finnish farm (Fig. 6). It is always built of logs spaced several inches apart. The flooring is raised from the ground a foot or two and is likewise made of spaced logging. Such construction allows the air to circulate freely through the hay, keeping it dry and helping to season it. The sides of the barn slope inward toward the floor. This characteristic is determinative. In only a few isolated cases has a Finn erected a modern scientific combination dairy and hay barn.

Slow Development of the Land

The cutting of timber, the grubbing of underbrush and roots, the dynamiting of stumps, the piling up of the boulders gathered from all parts of the land, and the draining of the wet places all follow in succession. The work is slow, for the Finn never hurries. Deliberate and determined, he is

FIG. 5.

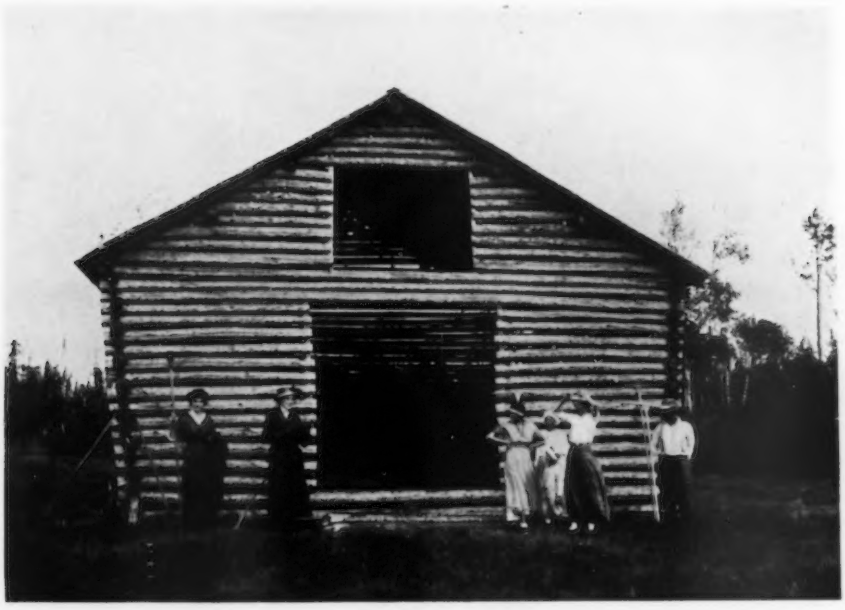

FIG. 6.

FIG. 5—The first home of the pioneer farmer, a two-room tar-papered shack. The man in the foreground is a Finn, but not the tenant of this hut. Embarass, Minn.

FIG. 6—The hay barn with sides sloping inward toward the floor. It identifies a Finnish farm. Floodwood, Minn.

seldom discouraged. Some day his land will be entirely cleared and beautifully developed. The Finnish immigrant makes an ideal pioneer, a splendid blazer of the trail; but the speedy development of the land awaits the rising generation. Whatever the length of time that must elapse before success crowns his efforts, the fact that a Finn is developing the land is always reassuring. To a farmer in the corn belt these northern lands must seem almost hopeless; but to the Finn, where there is land there is hope. His struggle through the many generations has taught him to keep at the problem until it is solved, if solution there be; and he is thankful for, and appreciative of every little gain. When his farm is well

FIG. 7—The old log cabin, and the modern dwelling: convincing proof of progress. Floodwood, Minn.

along he confines his efforts largely to such crops as hay, potatoes, rutabagas, and minor quantities of rye, oats, and barley. He possesses a number of cows, inclining very strongly toward the development of a dairy farm. Swine are conspicuously absent. A few horses, and not infrequently an automobile, complete his establishment.

REASONS FOR LOCALIZATION IN THE LAKE SUPERIOR REGION

In view of the many hardships with which the settler in northeastern Minnesota must contend, one naturally wonders why the Finns continue to assemble here. Did the first few who happened to come to the copper mines of Michigan so stimulate the successive immigrant flow as to give it a momentum sufficient to maintain itself to the present day? Could the momentum of the first influx have resulted in the concentration of about 150,000 Finns, or three-fourths of all the Finns in the United States, in the Lake Superior district? Why have not the more recent immigrants settled in the central

states? Why have not those who came twenty years ago moved further south after working under such severe strains and in the face of possible failure? To determine whether the factors are geographic in any degree, one needs to consider the natural environment in Finland and to compare it with that of northeastern Minnesota, and to study the life of the Finn in Finland, both past and present.

Finland vs. Northeastern Minnesota

The total population of Finland in 1910 was 3,115,197.[9] Its area was 144,252 square miles. The density therefore is between 21 and 22 per square

FIG. 8—A typical Finnish log cabin with windows which identify the nationality. The corners of the cabin are boxed off and the logs are squared, the squaring being done after the logs have been put in place. It represents a bit of Finnish mechanical skill. Toivola—"the place of hope"—Minn.

mile, a very low value compared with that in other countries of western Europe.

SURFACE RESEMBLANCES

Finland is a vast region of lakes, rivers, and marshes. Its very name in the Finnish language, Suomi, means "swamp land." Lakes occupy 11.73 per cent, swamp and peat surfaces 30.8 per cent of the total area of the country.[10] These figures are approximations, for they do not include large areas that are neither lake, swamp, nor peat bog, yet are very poorly drained. A map[11] of Finland showing the wet lands indicates that well

[9] Census figures: for characteristics of distribution see Atlas de Finlande, 1910, 1 vol. of maps and 2 vols. of text, Société de Géographie de Finlande, Helsingfors, 1911.

[10] "There are at least a quarter of a million lakes in Finland." See A. Hettner: Grundzüge der Länderkunde, Vol. 1, Europa, Leipzig, 1907, pp. 178–182.

[11] Work cited in footnote 9.

over 75 per cent of the surface area may be catalogued under this heading. The surface of northeastern Minnesota is closely similar. In St. Louis County 5.6 per cent of the surface area is lake, and 29 per cent is swamp and peat land.[12]

Finland has been completely glaciated. Excepting for a few small exposures of igneous rocks, the surface is entirely of drift material. Among the few outcrops Pre-Cambrian rocks predominate. Similarities with the Lake Superior region are suggested.[13] The Finnish geologist Sederholm indicates the possibility of stratigraphical correlation. Both Finland and Minnesota have boulder-strewn surfaces and in their respective localities present scenes that are almost identical. Prominent hills are uncommon; but the range of altitudes in Finland is almost exactly the same as that in St. Louis County. The land rises from about 250 feet close to the Baltic Coast, to 2,000 feet along the Russian boundary. In St. Louis County the range is from 600 feet above sea level at the shore of Lake Superior, to 2,000-2,200 feet in the northern parts of the county.

The streams crossing Finland, like those in northeastern Minnesota, are relatively short but rapid. Minnesota has no such famous rapids as the wonderful Imatra Fall; on the other hand, the variety and frequency of small rapids and falls are strikingly similar in the two countries.

Climatic Correspondences

The climates likewise show a close correspondence, that of Finland being somewhat less extreme. The coldest and warmest months in Finland are February and August respectively, whereas those in St. Louis County are January and July. In the former country in January the temperature ranges from 6° F. in the north to 14°-21° F. in the south, whereas in the latter region the range is from 4° F. in the north to 12° F. in the south. In July the range in Finland is from 56° F. in the north to 60° F. in the south, while in St. Louis County it is from 64° F. in the north to 66° F. in the south. There is however a great difference in latitude between the two regions. Finland extends from 60° N. to 70° N.; St. Louis County reaches from not quite 47° N. to 48.5° N. Finland tempered by the warm prevailing southwesterlies blowing from the Gulf of Bothnia and the Baltic Sea shows a very high temperature anomaly—at least 10° F. higher than the normal for the latitude—the divergence being specially great in winter. St. Louis County, in a continental area, is modified by the influence of a considerable body of water only along the short Lake Superior shore line.

The precipitation in Finland averages from 12 inches in the north to 27 inches in the south; in St. Louis County it is much more uniform, averaging from 27 inches in the north to 30 inches in the south. The amount

[12] Figures based on Leverett and Sardeson: Surface Formations and Agricultural Conditions of Northeastern Minnesota, *Minn. Geol. Survey Bull. No. 13*, Minneapolis, 1917, p. 56.

[13] See the section on Finland in Van Hise and Leith: Pre-Cambrian Geology of North America, *U. S Geol. Survey Bull. 360*, pp. 51-53.

of moisture falling as snow, ranges in Finland from 30 inches in the extreme northern parts to 55 inches in the south, and in St. Louis County averages from 50 to 55 inches. The annual distribution of the precipitation may be considered identical in both places. The dates for the appearance and disappearance of both snow and ice are practically the same. February and March are the months of maximum snowfall. Frost may occur in any month of the year in the swamp areas of both regions.

Similarity of Flora

With similar soils and climates one may look for a similarity in native flora. The evergreens predominate in the northern parts, while the deciduous trees are most common in the southern portions. Pines, spruce, tamarack, mountain ash, birch, and aspen are the best known among the many varieties of trees. While the species of trees are not in every instance the same, their effect upon the landscape does not differ. The swamp lands in both countries are alike, excepting for the somewhat more extensive lowland type of swamp in Finland. Peat is common to both areas. The wild flowers are strikingly similar, as witness

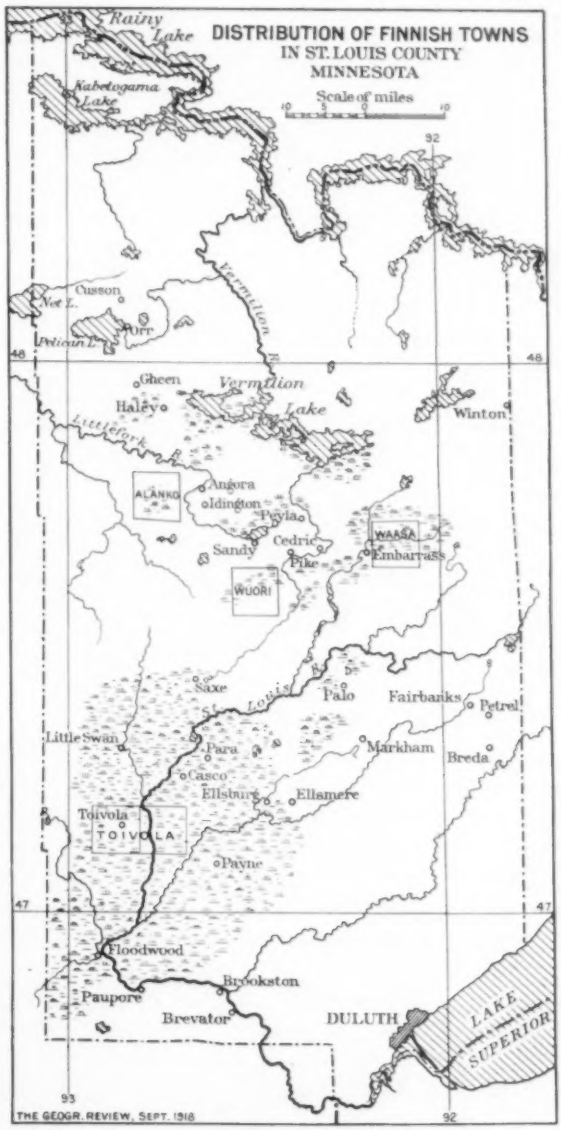

Fig. 9—Sketch map showing the distribution of towns essentially Finnish in population in St. Louis County. In a few cases there is a fairly large number of other nationalities. Distribution should be noted in reference to swamps, streams and lakes of which only the larger features are shown. Swamps are mapped from Leverett and Sardeson, *op. cit.* footnote 12. Scale 1:1,400,000.

the following description of a scene in Finland which will apply equally well to northeastern Minnesota: "I remember that meadow distinctly . . . a mass of giant bluebells, oxeye daisies, pink phlox,[14] yellow buttercups, and countless other varieties of flowers all growing pell-mell in a chaos of colors."[15]

Agriculture

From 80 per cent to 90 per cent of the people in all parts of Finland are engaged in agricultural pursuits. The principal crops in descending order of rank are oats, potatoes, rye, and barley. Wheat is produced in minor quantities in the southwest. Corn is said to be grown as a decora-

Fig. 10—This generous distribution of large-sized glacial boulders is typical of the region selected by the Finnish farmer. Near Chisholm, Minn.

tive plant in gardens. Hay, mostly wild, is important, for it constitutes the foundation of the dairying industry. Truck-garden products are grown for immediate family use. All of these crops are grown in northeastern Minnesota. Excepting hay, they are not grown so largely, but that is only because of the relative newness of the region.

In northern Finland the number of cattle is 500-1,000 per 1,000 inhabitants; in southern Finland the number is not so large, but is still important. Swine are notably few, especially in the north where their density is 0-10 per 1,000 inhabitants.

With respect to live stock Minnesota again resembles Finland. Northeastern Minnesota is developing rapidly into a dairy country. Swine are kept in decidedly larger numbers by the Finns in America than by those in Finland. Yet it may be noted that the Finns in St. Louis County keep fewer swine than do the farmers of other nationalities. This evidently is a reflection of conditions in their native land.

[14] This name may apply to the plant known as fireweed, very common and attractive in northeastern Minnesota.

[15] Paul Wainman: A Summer Tour in Finland, New York, 1908.

Industries and the Co-operative Plan

The variety of important industries in Finland is very small, as might well be expected in a region where raw materials are so limited and where agriculture offers practically the only visible means of gaining a livelihood. Lumbering takes first rank. Saw-mills are very numerous, especially in the coastal districts. Paper making ranks second. Beyond these two industries it is not possible to rank any of consequence as yet. St. Louis County differs only in having iron ore in tremendous quantities and in the consequent development of the mining industry.

The Finns have much faith in co-operative establishments for the conduct of their affairs, as is evidenced by the numerous co-operative

Fig. 11—The Finn places his grain and hay crops on driers, a custom brought from home. This is an oat crop at Palo, Minn.

creameries, co-operative general merchandise and grocery stores, co-operative savings banks, and other co-operative institutions. In 1913 there were 2,167 co-operative societies in Finland with a total membership[16] of 196,000. Into northeastern Minnesota co-operative institutions are rapidly finding their way. While all varieties are not yet represented there they may be found in the Lake Superior region as a whole. In addition the co-operative hotel has grown to be a significant institution.

The Finns in Finland

In order that the Finns in America may be fully and properly appreciated, a glimpse of their life in Finland is essential.

Origin

The history of the Finns is wrapped in romantic mystery. Theories as to their place of origin and their wanderings are abundant. That they are

[16] Hannes Gebhard: Co-operation in Finland, London, 1916.

of Asiatic origin has been very generally held. Keane says, "Many of the European Finns, and especially the Baltic group, have undoubtedly been largely assimilated to the surrounding populations, although even these retain certain physical and mental characters, such as peaky eyes, somewhat flat face, round head, dull sullen temperament, which, combined with their pure Ural-Altaic speech, betray their primordial Mongol affinities."[17] It is however rather with Turanian peoples that affinities may be found. The case is stated by Haddon[18] who assigns to the Finno-Ugrian stock a home about the headwaters of the Yenisei. The Finnish branch wandered across the Urals, the true Finns ultimately proceeding up the Volga into what is now Finland. But this view of the Asiatic origin of the Finns is not universally held. Ripley claims for them a Nordic origin on anthropological grounds.[19] What seems to be near the truth of the matter is suggested by Dominian[20] who states that while the culture is Asiatic the Finns are racially a blend of Nordic and Asiatic. Recent anthropometrical work points to a diversity of origin. The Finns were formerly described as a brachycephalic people, a feature in agreement with their supposed Turanian origin. Actually both dolichocephalic and brachycephalic forms are found, in proportions varying in various parts of the country.

The principal recent work has been done by Dr. F. W. Westerlund, who with the assistance of others took the head measurements of 131,697 men of about 21 years of age.[21] His work has been summarized by another Finnish authority[22] who gives the following figures: In southwestern Finland 55 to 58 per cent are dolichocephalic; in some parts of southern Finland as many as 70 per cent; in western Finland 65 per cent are dolichocephalic. In central Finland only 40 per cent are in this class. In eastern and northern Finland 73 to 88 per cent are brachycephalic. It is from the latter region that most of the Finns in America come; from whom we derive our impressions with regard to the whole of Finland.

Mythology; Nature Worship

Something more of the lives of the early Finns is related in their mythology. That they have always been nature worshippers is evident throughout their literature. "The ancient Finns were worshippers of the sun and of fire; they were highly superstitious and had faith in miracles and magic. . . . Their supreme God was Ukko, the God of Thunder, who lived in the clouds and who ruled human destiny."[23] They worshipped

[17] A. H. Keane: Ethnology, University Press, Cambridge, 1896, p. 305.

[18] A. C. Haddon: The Wanderings of Peoples, University Press, Cambridge, 1912, pp. 18, 19.

[19] W. Z. Ripley: The Races of Europe, New impression, New York, 1915, p. 365.

[20] Leon Dominian: Frontiers of Language and Nationality in Europe, New York, 1917, p. 102.

[21] See also the work cited in footnote 9, Vol. 2 of text, p. 56 of Ch. "Statistique démographique." See also the cartogram showing proportional distribution of forms.

[22] J. J. Mikkola: "Suomen kansa antropologisessa suhteessa," in Vol 1 of Oma Maa, 6 vols., Porvoo, Finland, 1907. This work is an encyclopedia of Finland. The statements in the text were summarized from the above article and were translated from the Finnish by Dr. K. V. Arminen of Duluth.

[23] George Renwick: Finland Today, New York, 1911.

Tapio, God of the Forest; Ahti, Ruler of the Waters; and Tuoni, Lord of the Nether Worlds. The sons and daughters of these gods were the gods and goddesses respectively of the sun, moon, stars, fire, and air. "In the Finnish mythology, the air and meteorological phenomena occupy the foremost place among the manifestations of the Divine."[24] The modern Finns still exhibit an intense love for and devotion to the open air. No weather seems too severe, no land too poor to prevent their deriving from it something well worth while.

The very names of the Finnish people are based upon natural features. A short list of the most common names with their English meaning is worth giving: Lahti, "bay"; Koski, "waterfall"; Vuori, "mountain"; Harju, "ridge"; Hirvi, "moose"; Korpi, "swampy woodland"; Järvi, "lake"; Nurmi, "pasture"; Joki, "river"; Niemi, "cape"; Saari, "island"; Koivo, "birch"; Kangas, "moor"; Hirsi, "timber"; Kantola, "stump land." These names occur as frequently among the Finns as "Smith" and "Jones" among Americans. Some estimates give 60 per cent as the proportion of Finnish names based upon topographic features.

Music

The music of the Finns reflects their environment. It is written largely in the minor key. Sadness, seriousness of life's struggles, vain hope, and work, work, work, are the words and expressions that pass through one's mind as one listens to their melodies. Some of their folk songs, however, are quite cheerful. One is reminded of rapids and waterfalls separated by quiet reaches. The song is quite different from the heavily accented folk song of the Slavic peoples of southern Europe. It seems to be very decidedly influenced by the presence of the numerous swiftly-flowing streams of Finland.

The Kalevala

One of the most interesting expressions of Finnish life is the great Finnish epic, the Kalevala,[25] a dramatic record of the struggle for existence that has ever confronted the Finns. In Finland it is studied in the schools, and in this country dramatized selections from it are presented on gala occasions.

The Kalevala is a splendid record of the response of a people to their geographic environment. A complete analysis of it is not possible here. Yet some extracts must be cited, for modern Finnish agriculture and respect for nature's gift to mankind could not be fully appreciated without a little reflection upon some of the verses of Finland's wonderful epic.

It was common in early times, and in fact to within the last twenty-five years, for the farmer to burn over the land that its fertility might be increased. Experience and scientific investigation have shown this proced-

[24] J. C. Brown: People of Finland in Archaic Times, London, 1892.
[25] Accented on the first syllable.

ure to be very unwise, for the land loses its fertility very rapidly three to four years after the burning. In the Kalevala reference is made to the burning of the forest that the ashes may enrich the soil:

> "Hark! the titmouse wildly crying,
> From the aspen, words as follows:
> 'Osma's barley will not flourish,
> Not the barley of Wainola,
> If the soil be not made ready,
> If the forest be not leveled,
> And the branches burned to ashes.'"[26]

A familiar picture of the Finnish landscape is given in the farewell song of Pohyola, daughter of the Rainbow:

> "Send to all my farewell greetings,
> To the fields, and groves, and berries;
> Greet the meadows with their daisies,
> Greet the borders with their fences,
> Greet the lakelets with their islands,
> Greet the streams with trout disporting,
> Greet the hills with stately pine trees,
> And the valleys with their birches.
> Fare ye well, ye streams and lakelets,
> Fertile fields and shores of ocean,
> All ye aspens on the mountains,
> All ye lindens of the valleys,
> All ye beautiful stone lindens,
> All ye shade trees by the cottage,
> All ye junipers and willows,
> All ye shrubs with berries laden,
> Waving grass and fields of barley,
> Arms of elms, and oaks, and alders,
> Fare ye well, dear scenes of childhood,
> Happiness of days departed."[27]

Among the many favorite trees of the Finns, the graceful white-trunked birch is most admired, indeed one might almost say it is revered. Even in northeastern Minnesota the Finn will stop before a beautiful group of nodding birches to admire the clean white dress of bark and the spreading branches that seem to bid him welcome. The Kalevala makes clear why his love for the birch is so enduring. The tree speaks:

> " . . . I, alas! a helpless birch tree,
> Dread the changing of the seasons,
> I must give my bark to others,
> Lose my leaves and silken tassels.
> Often come the Suomi children,
> Peel my bark and drink my lifeblood;
> Wicked shepherds in the summer,

[26] Kalevala: Epic Poem of Finland, translated by J. M. Crawford, Cincinnati, 1888; passage from Rune II, "Wainomoinen's Sowing."

[27] *Ibid.*, Rune XXIV, "The Bride's Farewell."

Come and steal my belt of silver,
Of my bark make berry baskets,
Dishes make, and cups for drinking.
Oftentimes the Northland maidens
Cut my tender limbs for birch brooms,
Bind my twigs and silver tassels
Into brooms to sweep their cabins;
Often have the Northland heroes
Chopped me into chips for burning;
Three times in the summer season,
In the pleasant days of springtime,
Foresters have ground their axes
On my silver trunk and branches,
Robbed me of my life for ages.''[28]

The Finns Today

The Finns have struggled against titanic handicaps of physical circumstance. With the country a vast region of lake and morass, with only diminutive areas here and there suitable for cultivation without the necessity of drainage, with lowland pockets in which cold air may collect to cause premature frosts and destroy in a night that which represents the labor of months; with few raw materials for the manufacture of articles that might aid in the maintenance of prosperity; with no surplus of food for storage over periods of scarcity; with all these factors to obstruct their way, they nevertheless have risen among the peoples of the earth to a position which many might well envy. ''One can not but be impressed with the industry and pluck of this valiant little people, and feel in sympathy with the Finnish economists who see in the geographical location and the magnificent water power of their country the basis for a great development in the future.''[29] But meanwhile growing political oppression has added a final weight of adversity and many Finns, giving up hope of bettering their condition in Finland, have sought freedom and opportunity in the United States.

The Finns in Northeastern Minnesota (St. Louis County)

Yet man is the creature of his native environment however ungrateful it may be. Its strong hold is exemplified here: given freedom and land the Finn in the United States will select an environment that reminds him of the home of his fathers. From what has been depicted thus far we are led to the conclusion that the attraction of the Finn to northeastern Minnesota has a geographical basis. It remains to offer direct evidence in confirmation.

[28] Kalevala: Epic Poem of Finland, translated by J. M. Crawford, Cincinnati, 1888; passage from Rune XLIV, "Birth of the Second Harp."

[29] W. E. Lingelbach: Geography in Russian History, *Popular Science Monthly*, Vol. 86, 1915, pp. 5-24.

Interviews with Representative Finns

Sixty Finns, many of them heads of families, representing various walks of life, have been interviewed by the writer. Some of these people were in a position to speak for hundreds of others and therefore their

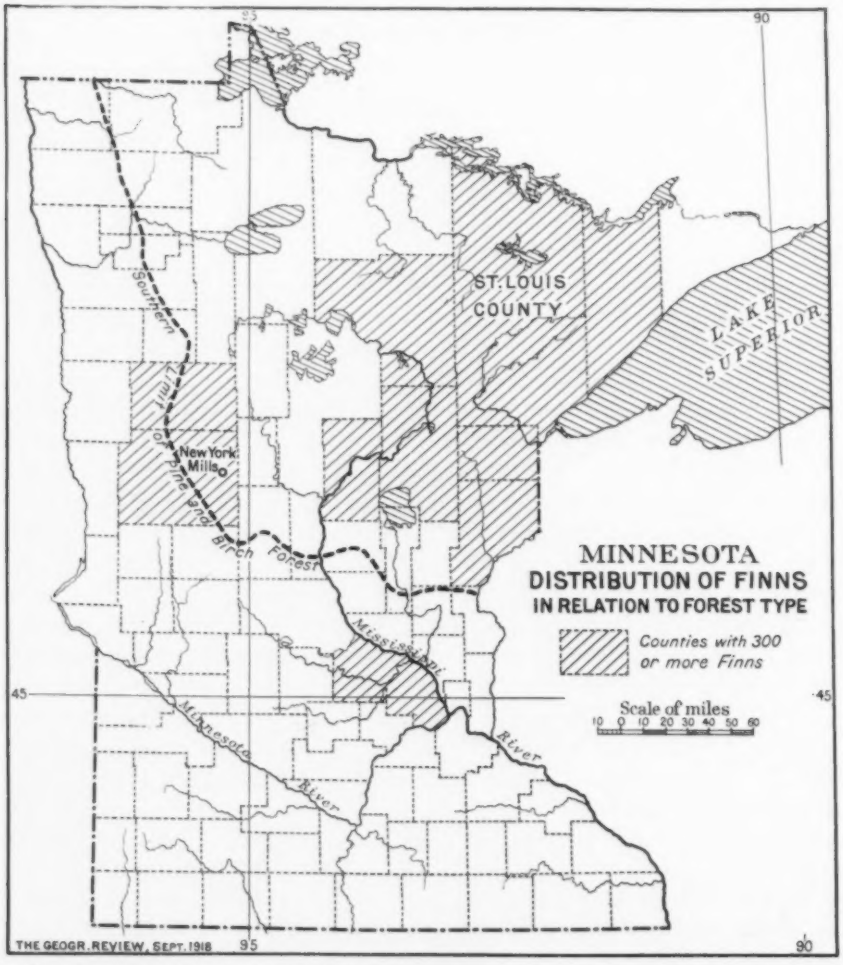

Fig. 12—Correspondence of Finns and the coniferous and birch forest. New York Mills accounts for most of the Finns in the county in which it is situated. Scale 1:5,100,000.

statements are representative of large numbers. Further, employers of from just a few Finns to upwards of 1,500 have been interviewed. The discussion that follows is a summary of the many opinions expressed by both Finns and non-Finns, and may be accepted as unquestionably reflecting reliable and accurate points of view.

With no more than ten exceptions, everyone interviewed volunteered unqualifiedly some geographic element as the principal reason for either

the establishment of Finnish colonies in northeastern Minnesota, or for their persistence in spite of the adverse living conditions. Climate ranks first among all the reasons assigned. Of 42 interviews, 30 indicated climate as the prime cause for settlement in the northern United States, instead of central or southern, and 12 asserted that friends were the influencing factor. Of these 12, all but 2 stated as their reason for remaining in northeastern Minnesota the similarity of the country to their homeland, both in general appearance and in climate. Again, emphasis is laid upon the fact that these 42 interviews are representative of the opinions of thousands of Finns. A few quotations will be significant. These are in reply to such questions as "Why did you come to St. Louis County?" "After your arrival and your observation of the rather unpromising conditions, why did you not go further south or return home?" "Why have you remained in these parts so long, when you have known of opportunities elsewhere?"

A clerk in charge of a Finnish co-operative store in a township populated by 59 Finns and their families replies: "The climate is similar to that in Finland. The winters here are somewhat less severe; the summers are a little warmer, but the days are shorter than in Finland." A student and school-teacher who has been in this country for ten years and has experienced the struggle for existence says: "Some came to work in the mines to make money, as my brother did, intending to return. But, like others, after a few years he quit the mine and began farming, his natural occupation. The similarity of this north country to Finland caused those who came before me to become enthusiastic and to send for their friends and relatives." According to the County School Supervisor of Agriculture, a Finn whose father claims to be one of the first two Finnish settlers in St. Louis County, "even now they [Finns] will buy land here in preference to taking up homesteads elsewhere even when conditions for farming are easier." A Finnish farmer of long residence, well acquainted with farming conditions in other regions, states: "Hearing of greater opportunities to make money elsewhere the Finns will not leave, for climate is the attraction here." "The Finns don't know how to choose land, for they select the stony and poorly drained lands seemingly in preference to the dry lands." This is the opinion of a Finn of many years experience in St. Louis County. He surmised that since their experiences in Finland had been with such poor land these similarly appearing areas "made them feel at home."

Many referred to their love for the deep snow and their admiration for the beautiful glacial lakes set among the dense evergreen forests. One who had seen much of the United States says that nowhere are the views so nearly like those in Finland as in the vicinity of Ely, in the northern part of St. Louis County. The myriads of lakes, the boulder-strewn interlake areas, the extensive woods of pines and birches are "just like home."

Several attempts have been made to colonize parts of the south with

Finns, but all have failed. Florida and Georgia were the states in which the principal efforts were put forth. Malaria played havoc, and the remnants of each colony returned to the north. Others have gone south only to find it too warm. Some have traveled westward to try their fortunes in a region not so warm as the south but milder than in Minnesota; they likewise have returned to struggle with the five or six months of a wet spring, a cool summer, and a bracing autumn, and six or seven months of a cold, snowy, but exhilarating winter.

FIG. 13—A contrast: modern hayrake and the ancient boots. These home-made boots are true to type, representing the Finnish style of a century or more. The farmer has been a resident of this district for 17 years. Floodwood, Minn.

Most of those who have gone west and remained there are engaged in lumbering, mining, and fishing. They have migrated largely in the path of the first two shifting industries. Many are fishermen, farmers, and some even shipbuilders. One of the largest canneries on the Columbia River is owned by a Finnish co-operative company. Until recently most of the migrants have been unmarried men and women. The women receive high wages as housemaids in western homes. Higher wages are generally the magnet that attracts; but the attraction seems to diminish in strength after a year or two, and the return of the adventurers to northeastern Minnesota follows in due course.

Every attempt to get away permanently from the Lake Superior region has failed. Thus it may be stated unhesitatingly that while non-geographic factors have played a part in the settlement of Finns in northeastern Minnesota, they have been only incidental, and the geographic factors have been primary. Clannishness has played its rôle only in so far as it has meant migration by groups; but the place of settlement by the

group, or the forerunners of a group, has been determined by natural influences.

Since the sum total of geographic conditions reflect themselves in citizenship it is but proper to turn the investigation toward the question of the Finn as a settler and a citizen.

The Finn as Settler and Citizen

Perseverance, doggedness, tenacity of purpose, and endurance characterize the Finn. These qualities oftentimes develop into extreme, even detrimental stubbornness. He has a strong desire for independence, an ambition to own a bit of land and to free himself from all "bondage." His fondness for the land is obviously the result of the centuries of influence of his native environment, but his zeal for the attainment of independence, to the extent even of complete isolation, seems to have resulted from the long period of political oppression.

The Finn is frequently stolid and phlegmatic until opposed by some one or some idea not to his liking, when he becomes thoroughly aroused. Among the lumberjacks and miners this spirit has often led to serious disruptions and sometimes even murder. However, it would be an injustice to the Finns as a whole to imply that this is as common a characteristic as is their attitude of suspicion.

The Finn's suspicion is difficult to explain. It is a most unfortunate characteristic. Either tribal raids of ancient times or comparative isolation on the scattered farms of Finland is the cause. The latter seems very plausible, for where there is isolation and little opportunity for self protection a stranger will necessarily be under suspicion until he proves his good will. However the idea of fear is not to be associated with the Finns, for few people are as courageous.

Educational Aspirations

The Finn appreciates the value of education. He is an enthusiastic reader. There is said to be less illiteracy in Finland than in any other country. According to the census statistics for 1910 of persons of 15 years of age and above only 9 per 1,000 are illiterate (unable to read). In Minnesota the Finn demonstrates his desire for mental growth by the attendance of his children in the public schools and his own attendance at night school. "The Finns demand schools no matter how remote they may be. The daily attendance record of their children is very high," says the St. Louis County Superintendent of Schools. In a town on the Mesabi Range, Minnesota, where the Finn constitutes only about one-tenth of the total population, the Superintendent of Schools reports that "he is the backbone of the night school. Out of a total attendance of 900 over 500 were Finns." Figure 14 illustrates the type of rural school which the

Finn attends. While he is not directly responsible for the modernity of the structure and the system of teaching which has been developed within it, he must be credited with his willingness to contribute toward its support and toward the introduction of modern equipment.

Further evidence of educational aspirations is furnished by the extent of the Finnish press in the United States. Including four yearbooks, one may count 29 periodical publications. Of these, seven are Socialistic, one is an organ of the I. W. W., and the rest are liberal. The total circulation of these publications is as follows: Socialist 29,000, I. W. W. 3,500, liberal 59,000, yearbooks 20,000. This gives a grand total of 111,500. These

FIG. 14—A recently erected rural school house in the French River district of St. Louis County. It is one of the most modern structures of its kind in the country. Nearly all the pupils attending the school are Finns.

figures do not all represent different individuals who read these periodicals, for some subscribe to several of them. A single subscription however may reach many individuals: one must take into consideration not only the several members of a usually large family but also the fact that many Finns live in community houses (co-operative hotels) and take advantage of the co-operative subscription.

The ability of so many Finns to read may be traced to the church, which is dominantly Lutheran. Over 80 per cent of the Finns are Lutheran (in America probably only 60 per cent). The church requires that every member be able to read the catechism and the Bible. Some Finns have ventured the opinion that the reading done by the masses does not go beyond church literature. Whatever truth there may be in this, the fact remains that nearly all Finns can read, that quite as many can write, and that they possess a keen appetite for learning.

Health and Hygiene

Strangely, the appetite for learning and the high state of intelligence among the Finns have not served to improve all their hygienic environment. In general all the home and business establishments which were visited were immaculately clean. This was found to be so, however humble

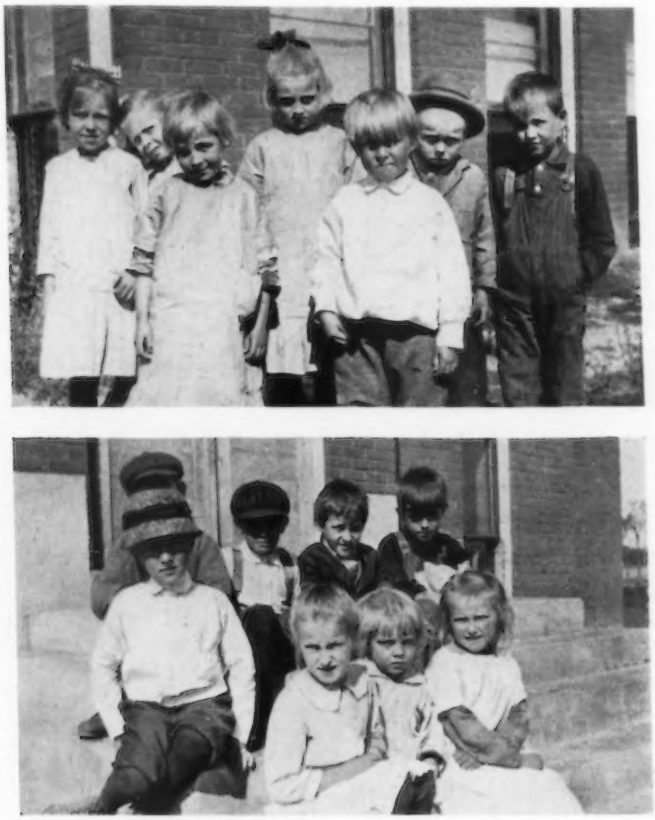

Fig. 15—The children in the upper group have just started school: they cannot talk English. Those in the lower group have been in school little more than a year and can talk English. Notice how readily these Finnish children become assimilated. Those in the lower group seem to have lost some of their foreign features. (Photo by Miss Betty Stonerock, Little Swan, Minn.)

the home; but, with only a few exceptions, proper ventilation was lacking. This is proving the death knell of many a worthy Finn, for it is courting successfully the spread of tubercular diseases. Furthermore the belief is still common among many of the older Finns that diseases are not contagious and that the contraction of a disease is the will of God. A similar apathy towards ventilation is shown in the management of their barns. Diseases among their live stock are all too common.

In partial justice to this attitude toward ventilation one should note carefully at least one important responsible factor. In the north of Finland it is bitterly cold in winter, and fuel, excepting wood, is scarce. The atmosphere is humid, and the sensible temperature is therefore quite low. Under these circumstances, conservation of heat as a matter of economy has undoubtedly led to the sealing of the log cabin windows and doors. Isolation from medical help has readily established credence in the theory that disease is not communicable and is incurable if the Finnish

FIG. 16—The Finnish bathhouse. The man is holding a couple of Finnish rakes. Floodwood, Minn.

bath does not prove effective. The faith of centuries cannot be broken in a single generation, and failure on the part of the immigrant to reform at once can be understood. The teaching of the principles of hygiene and sanitation to the children, however, in the magnificent rural and city schools of the county is proving an effective agency for betterment of home conditions. The rising generation will not have the faults of the older people.

THE BATH

The bathhouse (Fig. 16) is the "sign of the Finn." It is one of the first of the many buildings to be erected upon his farm. Figure 17 is a photograph of a stove in the bathhouse. That the house is dark is well attested by the picture. Glacial boulders gathered about the farm are piled up so as to leave a low ovenlike space at the base, extending well back under the rocks. A fire is built in this stove and allowed to burn only until

heat has penetrated every stone. Buckets of cold water are then thrown upon the stove, and a vast cloud of partially condensed steam fills the small room. Occasionally a single special vent in the roof allows the smoke and the excess steam to escape. But more often the cracks in the walls and ceilings and the space around the door casement perform the same function. When the latter is the case the uninitiated might suppose the bathhouse to be afire. The neighborhood knows when a Finn bathes, for the smoke and clouds issuing from all sides of the bathhouse are an index

FIG. 17—The stove in the bathhouse of Fig. 16.

to what is happening within. Several platforms at varying heights around the room allow of a certain adjustment to the degree of heat. The bather beats himself with a bunch of birch or aspen leaves. After about ten to twenty minutes in the steam bath he retires to a small adjoining room where he dashes cold water upon himself. He then drys himself and runs to his house where he dresses. In winter he may roll in the snow before returning to dress. For nearly all ailments the Finn applies one of these vapor baths. His training from childhood enables him to endure its rigors, and hence the benefits he derives are large. His faith in it is unbounded.

The Finnish bath introduces an element in the survival of the fittest, for babies are subjected to it. The infant mortality is very high. Were it not for the anti-ventilation sentiment among so many Finns their health would undoubtedly rank first among the peoples of the earth. Those of them who do observe the modern principles are rarely ill.

Whole families very frequently bathe at the same time. The house is large enough to accommodate from eight to ten people if necessary. Herein is undoubtedly one of the basic reasons for the high moral plane of the Finn. Members of both sexes, beginning with childhood, are educated in the form of the human body and, thereby, that ignorance in later life which so often accounts for sexual immorality is at once discounted.

The Finn as a Worker

Reference has been made to the excellence of the Finn as a worker. An employer of large numbers of Finns says: "We find that a great many of the Finns are very good men in every way; not only are they sober and steady, but they remain at their work for a period of years. These belong more often to the Temperance class." The Temperance class consists of the non-Socialists. Employers state that about 25 years ago the honesty of the immigrant Finn was never to be questioned. Today this statement does not appear to be so generally true, especially in the lumber camps. The change has been attributed to the spread of radical Socialism among them.

Political Parties

Politically, the Finns may be grouped into two classes, the Socialists and the Temperance or Progressive party. The Socialists are subdivided into two classes, the Reds and the Yellows. The Reds are the more radical and advocate force, if necessary, to accomplish an end; the Yellows oppose force and foster legislation as the best means for accomplishing a purpose. Some of the radicals have helped swell the ranks of the I. W. W. Socialism is growing rapidly, although the Progressive party says the days of the Socialists are numbered. The conservative Socialists credit themselves with all real progress attributed to the Finns. The Progressive class disagrees, crediting them only with the organization of modern athletic clubs and community opera houses.

The political aspect of the Socialist versus the Progressive party movement perhaps should receive no attention in a geographic discussion. Yet, the recent introduction of Socialism has influenced these people so strongly that it cannot properly be passed without some consideration. The question has often been asked, "Why should the principles of Socialism have found such fertile soil among the Finns?" Nearly 40 per cent of the population of Finland and perhaps 25 per cent of Finns in America now belong to the Socialist party. Most of the latter are settled in the mining districts. Geographic conditions may answer the question in part at least. The struggle with a climate that makes crops uncertain, the tilling of a soil that is difficult to drain, and the relative isolation of the farm—all increased in their severity by the Russian autocratic rule—prepare the individual to accept almost anything that savors of a somewhat easier life. In Minnesota, where the Finn labors in a lumber camp hardly fit for human habita-

tion, he soon develops an antipathy toward employers that is not easy to counteract. He then becomes a fit subject for conversion by agitators of the radical type and is easily won over. In striking contrast, however, is his attitude after he has established himself upon the land and has had an opportunity to experience the privileges of independence, even with hard work.

FIG. 18.--Excellent types of Finns: both leaders in their fields of work. On the left the former Mayor of Eveleth, Minn. On the right an attorney of Duluth, a man of ability and a leader among both Finns and Americans. He arrived in America at the age of 5 years.

DEVELOPMENT OF LEADERSHIP

The above statements might give rise to erroneous impressions relative to the desirability of the Finn as a citizen. It will, therefore, be worth while to look at the other side of the shield and note what sort of leadership has developed among them (Fig. 18). The last mayor of Eveleth, Minnesota, a city of about 8,000 inhabitants, was a Finn. He is a young man possessed of an aggressive spirit and of excellent business ability. He offers an example that seems to discount the common assertion that the Finn has no capacity for business affairs. The chief of detectives of Duluth stands as another splendid example of young Finnish leadership. The medical field has its quota of Finns who rank high, and the legal profession is worthily represented. Many schoolteachers in the county are Finns. They rank among the best in the state, and some have made scholarship

records in the normal schools that might well be envied by their non-Finnish classmates.

Respecting the Finn's place in world civilization it is interesting to note the rank assigned his country in Huntington's "Civilization and Climate."[30] Excluding the northern portion, Finland is ranked "high," on a level nearly identical with that awarded the Northern Prairie states. Classified on the basis of "human energy," Minnesota is somewhat more highly favored; but for southwestern Finland the ranking still is "very high." Accordingly the settlement of Finns in northeastern Minnesota is perfectly natural.

A Glimpse Into the Future

The Finn in Finland and the Finn in America present both similar and contrasting aspects. These have been discussed in the light of geographic conditions, with only occasional digressions to give a better background for the point of view. Now, in the light of the past and present, may something be ventured as to the future?

The similarity of topography, soil, and climate in Finland and northeastern Minnesota, it would seem, has been most influential in the settlement of Finnish immigrants in that part of the United States. The region is still thinly populated, and those interested in its further development are encouraging foreigners to settle. Should they seek Poles, Bohemians, Italians, Finns, or some other nationality? Considering the Finn's virtues and his defects and the fundamental facts of his evolution within a well-defined environment, there is no doubt in the mind of the writer that in the Finnish immigrant lies an assurance for the agricultural development of northeastern Minnesota. All his imperfections are not of his own making and can be corrected under proper influences. In the main, his life, his habits, and his customs have been shaped by certain unmistakable geographic conditions. These conditions are reproduced in northeastern Minnesota. The region has attracted him by reason of its general physical resemblance to his homeland, and thus far he has met with a degree of success in it which no other nationality has known. These facts should be recognized that they may be made available in the upbuilding of this part of our country.

[30] Ellsworth Huntington: Civilization and Climate, Yale University Press, New Haven, 1915; reference on p. 200.

ON "SAVSSATS": A CROWDING OF ARCTIC ANIMALS AT HOLES IN THE SEA ICE

By MORTEN P. PORSILD
Director, Danish Arctic Station, Disko, Greenland

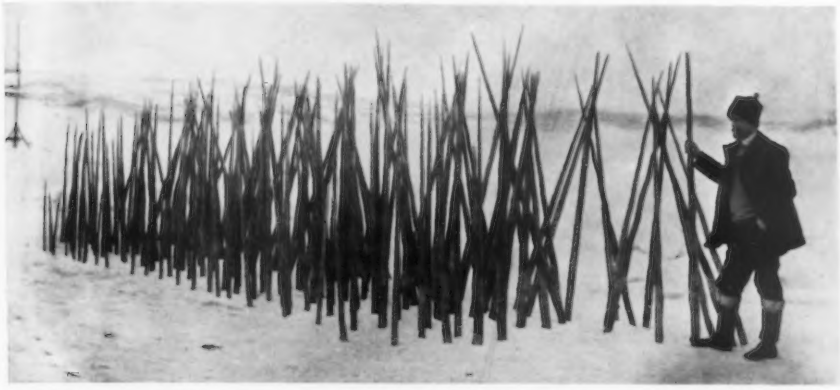

FIG. 1—Over 200 narwhals' tusks planted in the snow at Godhavn. They were obtained from the two savssats in the winter of 1914-15.

On the west coast of Greenland, at the 69th parallel, is situated Disko Bay, to the north of which lies the large island of Disko. Aligned across the mouth of the bay are several groups of islands, formerly called Whale Islands, in the modern Danish charts named Hunde Öer (the southern group) and Kronprinsens Öer (the northern group).

ICE CONDITIONS IN DISKO BAY

In summer the surface temperature of the waters of Disko Bay is considerably higher than that of the adjacent open sea in spite of the fact that two of the largest and most productive ice fiords, those of Jakobshavn and Torsukatak, there discharge large numbers of great icebergs. In winter, however, the bay is ice-covered as a rule and sometimes the covering lasts for months.

Normally the ice covering of most of the fiords and open bays of west Greenland begins to form at the head of the fiords, where the glaciers and glacier rivers debouch, and thence gradually approaches the open sea. In Disko Bay, on the contrary, the phenomenon often is reversed; the ice covering begins when the drifting ice of Baffin Bay, the so-called "west ice," has approached the coast, an event which ordinarily takes place during the last days of December.

The weather at this time of the year is apt to be rough and stormy; but after the approach of the west ice it becomes quiet; intense cold sets in;

the sky gradually clears, and the ice now grows rapidly from the island groups inward.

Icebound Narwhals

Then it often happens that schools of white whales or narwhals are cut off from the still open parts of Baffin Bay and are gradually driven in towards the head of Disko Bay. Freezing continues, and finally the schools

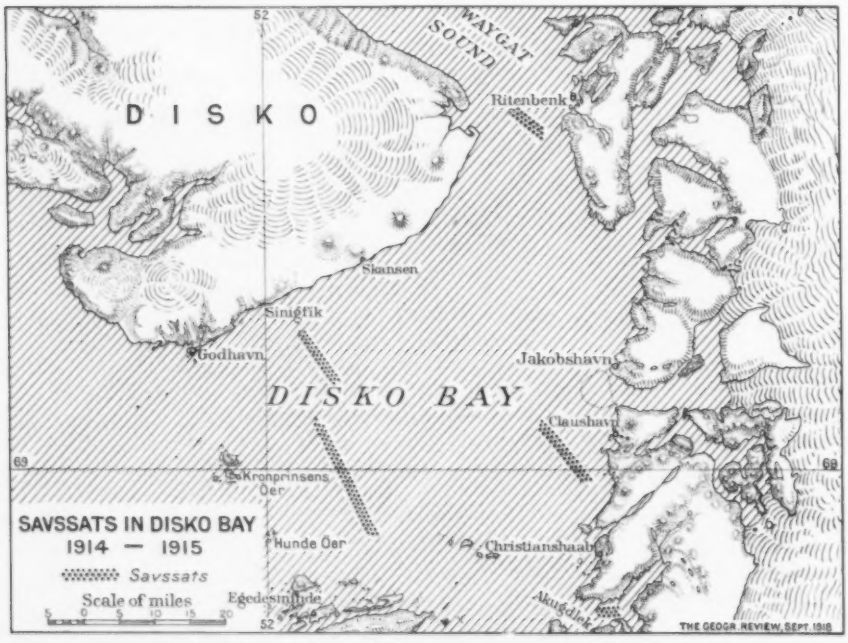

Fig. 2.—Map of Disko Bay showing *savssats*. The map has been traced from the author's copy from the Royal Danish Admiralty's chart of West Greenland. Scale 1:1,600,000.

are restricted to the last smaller or larger open spaces in the ice, whence they cannot escape unless the weather changes and the ice is broken. If no such change occurs a large school of whales may eventually find itself enclosed in a very small pool. When the temperature of the air is below −20° to −25° C., condensing vapors, visible at long distances, rise from every hole or every tidal crack. If a school of whales be inclosed in one of these pools the breath of the animals will expand the thin cloud to a substantial column and thus the inclosed animals may be easily detected, even from a distance, and they then become an easy prey for the inhabitants of the neighboring shores.

Although this phenomenon has been known for over 200 years and is by no means rare, it has never been described in literature from first-hand information; previous accounts have all been based on second or third-hand narratives. As I have had the good fortune to witness the behavior of

some extraordinarily large schools of narwhals thus caught in the ice, a little more detailed description of this peculiar phenomenon may perhaps be of interest.

Earlier Accounts of "Savssats"

The natives of Greenland have an Eskimo term, *savssat* (pronounced s'set), meaning something like "crowding" or "overcrowding" and used of living creatures crowded in large numbers into a small space. To the best of my knowledge, the *savssats* of Disko Bay are first mentioned by Paul Egede, eldest son and successor of the first missionary in Greenland, in his accounts of Greenland written from diaries kept from 1721 to 1788.[1] Since his time they have been mentioned by C. L. Giesecke,[2] H. Rink,[3] R. Brown,[4] E. Vanhöffen,[5] H. Winge,[6] and perhaps others. Lastly, I have published[7] a drawing by a native hunter and catechist, G. Kleist of Godhavn, showing the typical form of a *savssat* (see Fig. 5); and during the winter of 1914-15, I twice witnessed another form of *savssat*, heretofore not described, of which a record in Danish has been published.[8] The present paper is a somewhat elaborated translation of a part of the last-named publication.

The Severe Winter of 1914-15

The winter of 1914-15 was so extraordinary that even the old people do not remember its like. Severe cold set in with the new year, and the weather remained practically unchanged until late in April. The ice covering that developed was exceptionally heavy. From the middle of February to the last of March the ice was unbroken, at least from the 68th parallel (and perhaps farther south) to Etah on Smith Sound, 78° 20′ N. How far from the coast the unbroken ice extended at its maximum cannot be stated. To the west of Disko Island the firm ice, even in good years, seldom ranges more than six to eight miles and lasts ordinarily only for a very short time. But this winter, from heights of 3,000 feet on the west coast not the slightest indications of water could be discerned. The ice covering began to form at the outer termination of Disko Bay, from

[1] Paul Egede: Efterretninger om Grønland, uddragne af en Journal, holden fra 1721-1788, Copenhagen 1788. German edit., *ibid.*, 1790.

[2] C. L. Giesecke: Bericht einer mineralogischen Reise in Grønland (1806-13), Copenhagen, 1878. 2nd and complete edit. in *Meddelelser om Grønland*, Vol. 35, *ibid.*, 1910, pp. 1-478.

[3] H. Rink: Grønland geographisk og statistisk beskrevet I, II, Copenhagen, 1852-57. English trans.: Danish Greenland: Its People and Its Products, Robert Brown, edit., London, 1877.

[4] Robert Brown: On the History and Geographical Relations of the Cetacea Frequenting Davis Strait and Baffin's Bay, *Proc. Zoöl. Soc.*, No. 35, 1868, pp. 533-556. Reprinted in T. R. Jones, edit: Manual of the Natural History, Geology, and Physics of Greenland and the Neighbouring Regions, London, 1875, pp. 69-93.

[5] E. Vanhöffen: Die Fauna und Flora Grønlands. Grønland-Expedition der Gesellschaft der Erkunde zu Berlin, II, Berlin, 1897.

[6] Herluf Winge: Grønlands Pattedyr, *Meddelelser om Grønland*, Vol. 21, 1902, pp. 319-521.

[7] M. P. Porsild: Studies on the Material Culture of the Eskimo in West Greenland (Arbejder fra den Danske Arktiske Station paa Disko, No. 7), *Meddelelser om Grønland*, Vol. 51, 1915, pp. 111-250.

[8] *Idem*: Om nogle vestgrønlandske Pattedyr og Fugle, I, II (Arbejder fra den Danske Arktiske Station paa Disko, No. 10), *Meddelelser om Grønland*, Vol. 56, 1916.

South Disko to the mainland at Egedesminde; the inner parts of the bay, about the colony of Ritenbenk and the southern part of the Waygat Sound, were closed early in February.

Discovery of Two "Savssats"

At Godhavn, the chief trading post on Disko, and more especially at Skansen, a smaller station on south Disko some thirty miles east of Godhavn every one was certain that a *savssat* would occur unless the weather changed. Every day sledges went out eagerly searching, and finally, on the evening of February 10, Ludvig Geisler, the most clever and experienced hunter of the region, actually found a *savssat*. On his way home he met a sledge from Godhavn, which brought the news to that place late in the evening, and a few hours after midnight every one from Godhavn went out to the *savssat* with all the dogs and sledges the settlement afforded.

We followed the ordinary track along the shore to Sinigfik, nearly midway between Godhavn and Skansen, thence about six miles in a southsoutheasterly direction, and came to a belt of ice some 200 yards broad and about 6 miles long that had been frozen one day later than the surrounding area. This belt was not much thinner than the ice in general; but whereas the surrounding ice had a thin covering of snow on its surface, this field was studded only by the ordinary crystallizations always found on young sea ice and was thus far more transparent than the older sheet. There were no natural openings at all in it, but the school of narwhals finding this transparent belt assisted themselves by breaking open a number of holes, extending throughout the whole distance of the field (Figs. 3 and 4).

The natives took their position astride or close to the holes over the entire area. Every time a herd of narwhals appeared, they shot one or two and tied them to the ice or took them up and began flensing immediately. As the daylight lasted only a short time the slaughter had to be abandoned early. Towards evening the animals appeared to have avoided holes with blood until all holes were equally bloody. The next morning only a few live individuals were seen here.

Early in the proceedings Geisler had had the impression that the number of animals frequenting the *savssat* was far greater and that many had left the place frightened by the slaughter. As soon therefore as he had taken home the products of his kill, he went out in search of the next *savssat* and succeeded in finding it on February 19. As I was not at home and did not see that *savssat* until after my return on the 25th, when I visited the place a number of times, I have supplemented my observations with data collected by Mr. A. Bistrup, the chief factor of the colony of Godhavn.

The new *savssat* was of the same type as the former. This time the

series of holes extended over a distance of about twelve miles. The position of the northern end of the series I determined to be at 69° 3.2′ N., 52° 36′ W., its main direction being north-northwest to south-southeast, east of Kronprinsens Öer. This school was far more numerous than the first, and moreover we got the impression that every day brought new herds. They were apparently coming from great distances, were nervous, fatigued, and suffering from dyspnoea. At earlier *savssats* the Eskimos have had similar

FIG. 3—The northern end of the small *savssat* of Febr. 11th, 1915. To the right, towards the older ice is seen the border of the transparent icefield. Along the line of broken breathing holes are men occupied in flensing. In the background is the shore of Disko Island.

experiences, so that newcomers are confidently awaited as long as the weather conditions remain undisturbed. The fact that living animals were found at the holes on March 1 and 3, and probably still later, after several days had elapsed on which no live ones had been observed at all, seems to prove that they often come from great distances.

METHOD OF KILLING THE NARWHALS

At the first *savssat* about seventy animals were secured. Here were only people from Godhavn and Skansen, most of whom were experienced in that form of hunting and knew how to proceed systematically, so that there was no competition amongst them. Every man placed himself astride a hole with his rifle loaded, awaited calmly the arrival of a school, shot one of the animals—if possible a male with tusk—and harpooned it immediately after the shot; or, if he were exceptionally clever, he simply seized the animal by its nostrils or by one of the flippers. He then enlarged the hole, pulled his prey up, and proceeded with the flensing. It is imperative that the animal be cut up while yet retaining its bodily heat, for should the carcass grow cold before being drawn up on the ice it would quickly freeze

FIG. 4—Men occupied in flensing. The hole has been enlarged for dragging the narwhal onto the ice. In it floats another dead narwhal. To the right is a hole broken by narwhals, with cakes of ice lying about it.

FIG. 5—A *sursaut* off Godhavn, West Greenland. Narwhals are crowded together in two small openings in the ice. Some people are securing right of possession by thrusting harpoons into them; others are drawing them up and driving the blubber home on sledges. In the background, to the right, sledges are coming from the settlement at Skansen. From a drawing by the native Greenland hunter and catechist, G. Kleist. The original reproduction may be found in the author's paper mentioned in footnote 7.

so hard in the extremely cold air that saws and axes alone could effect the cutting

When the school had run out the whole line, it would turn and come back; each hunter, apprised of its coming by the shooting of those before him, would in turn deliver his shot as before. By this procedure the cleverest and coolest of the hunters got up to seven animals a day without leaving the spot first chosen. Others, less experienced, were not so methodical; running bewildered from one hole to another, they got as a rule nothing of their own, but had at last to content themselves with assisting others in dragging up their prey. Some, lacking all experience and self-control, shot as soon as an animal came to the surface and succeeded only in piercing the cushion on the forehead, after which the harpooned animal could not be held or it would sink stupefied but not killed. The experienced hunters waited till the narwhal had blown, again breathed, and was in the act of turning downwards. The bullet then proved fatal every time, piercing the brain or the back of the head. According to the observations of Mr. Bistrup and myself and estimates made by experienced Eskimos of my acquaintance the number of animals killed at this *savssat* was between two and three hundred.

Scenes of Confusion

Rumors and news spread very fast in western Greenland, especially during winter, and after the second *savssat* had been found people came from nearly every inhabited place between the 68th and the 72nd parallels and from even further south. Some were over six days on the trail and had to cross the Nugsuak Peninsula with its two mountain ranges over 3,000 feet high. The settlement nearest to the *savssat*, Kronprinsens Öer, was the last of all to get the news.

According to narratives of persons who saw the first and worst days of the second *savssat*, a state of total anarchy prevailed. Those who came from a distance had not had much experience in these operations; there was constant confusion about the holes over the whole twelve-mile line. Consequently skillful hunters did things they otherwise would not have done; for instance, one young hunter killed on one day five large males, took merely the tusks, and let the carcasses sink. His profit for that day's work amounted to five months' wages of a day laborer in Greenland! At last people began to rob each other. Dogs starved from the long journey without rest, gnawed through their traces, and ran about loose and uncontrolled on the killing place; some were stolen and carried off; and only the deep-rooted Eskimo good nature and good behavior prevented serious trouble. The Greenlanders have a sort of self-government in their village councils, but neither the councils nor the Danish officials could maintain any order at this *savssat*. It is, and always has been, one of the principles of the Danish administration of Greenland not to interfere with Eskimo unwritten rules of hunting

and division of the spoil, rules which are handed down from one generation to another.

The Profits

During the first days of the second *savssat* a far greater number of narwhals were thus killed than were secured, for most of them sank. On April 7 I traveled over the whole field of slaughter and counted on the ice over 200 carcasses. Assuming that the ratio of animals secured to animals killed was the same at the second *savssat* as at the first—though in reality the proportion lost was much greater at the second—we may conclude that over 1,000 animals were killed at the two *savssats* together.

And what was the ultimate gain of this unusual winter with its unusual *savssat?* For most of the people a rather negative one, as in such a season there is always the disadvantage of too much ice for successful sealing. At the two nearest settlements, Godhavn and Skansen, the people got plenty of hide—to the Eskimo the most palatable and desirable portion of a whale; they had plenty of meat; and from the sale of the blubber and tusks they deposited fair sums in the savings banks. But for people coming from afar, the profits were reduced to some hide, or at most a tusk, that would be converted into European luxuries at their own trading stations.

A Human "Savssat"

At Skansen, the nearest settlement on the way to the *savssat*, the people also participated in another and less pleasant kind of *savssat*. When I passed the place homeward bound, on February 25, the eight houses were overcrowded with foreign invaders never before seen here. They came worn out, lacking food and sleep, without dog food, without money—though in fact money was useless and undesirable because every inhabitant of the place was interested in keeping the contents of his own small store for himself and his fellow-villagers. This was particularly the case because the war in Europe, news of which had come to Greenland without definite reports as to its extent or the possibilities of Denmark's being involved, necessitated the utmost precaution in conserving as long as possible the limited supplies held in the stores. The men from Skansen came home late in the night, hungry and tired from their work and from a heavy sledge trip of five or six hours, slept a few hours, and went out again over the same way. In their houses they literally had to wade over the floors covered with sleeping intruders; while in front of the houses some three hundred greedy, masterless dogs ran about, storming the cached meat and hides, skins, rawhide thongs, whips, garments, boots, and all else eatable and constantly fighting with one another or with angry, scolding women and children.

When I passed the line of carcasses in April, it seemed to me that all the ravens of Greenland had assembled there. They rose in clouds. Some

days afterward the weather finally changed, and a part of the ice went out carrying off the carcasses. But as late as May 15, I saw large ice fields with carcasses driving slowly out of the bay, and the people of Kronprinsens Öer were now busied in securing dead narwhals that had reappeared.

Smaller "Savssats"

In addition to the *savssats* here described a small *savssat* of white whales occurred near the settlement of Akugdlek on January 8, yielding but half a dozen animals. According to records kindly sent by Mr. C. E. Lembcke-Otto, chief factor of the colony of Christianshaab, a *savssat* of narwhals was found on March 15 south of Claushavn. By people from the various settlements in this district some 130 animals were captured, of which 77 specimens had tusks. In addition some animals were killed by people of other districts, who delivered their products to their own trading posts. The *savssat* lasted about one week, when the ice became so badly tideworn that hunting was dangerous and had to be abandoned.

Finally in April a *savssat* of white whales near the colony of Ritenbenk yielded over 25 animals.

The following year there was a bad winter with not much ice. At nearly all neighboring settlements a larger number of sharks (*Somniosus microcephalus*) were observed than is usual, the capture of which is an important source of revenue to the natives. This increase in numbers was undoubtedly due to the abundance of food they had obtained from the *savssats*, to which they had been attracted during the year.

Bird "Savssats"

Sometimes sea fowl are surprised by sudden freezing of the sea. Eider ducks are often seen at the beginning of the winter crowded in hundreds in relatively small openings, but they always seem to be able to escape. Not so fortunate are various species of the Alcidae, viz. the black guillemot (*Cepphus grylle*), the little auk (*Mergulus alle*), and especially Brünnich's guillemot (*Uria arra*). Flocks of thousands of the latter species are not infrequently seen crowded in small openings. If such a guillemot *savssat* occurs near the shore, the birds are all captured. They are almost indifferent to their fate, as if they realized the futility of attempted escape. They only swim unquietly about and as a rule do not try to leave the hole.

If the hole be far from any settlement the whole flock gradually perishes here in the freezing. I saw such a case during the winter of 1908-09 near the Kronprinsens Öer. The opening here had originally had a diameter of over a mile; when I passed, the whole field was covered with ice, rather thin but safe enough for sledging. Over it could be seen elliptical humps of ice, some of them with a small fissure at the top, through which heads of birds protruded. A few birds could still withdraw their heads, dive for a few moments and return. Others could not withdraw the head, the

opening being narrowed to a mere fissure in which the head moved restlessly and without meaning, the water continually welling over through the fissure. By far the most had succumbed. Over the solid frozen humps rose their small black heads with closed eyes and beaks pointing straight upwards.

On one occasion sledges on the track over the Waygat between Ritenbenk and Disko met flocks of the little auk flying over the ice-covered sea.

FIG. 6—Above a young male narwhal, ventral side. The small tusk is visible. Below a female narwhal of nearly the same size, ventral side. The lighter coloring of the female is apparent. Behind the female is a hole still undisturbed by the hunters, with a dead narwhal floating in it.

When the birds met the sledges, they fell in showers over them and the dogs. The Eskimos think that they become snow-blind in flying great distances over ice and that they then fall on every dark thing, supposing it to be an opening in the ice. When some days later I drove the same way, I saw no live birds, but along the whole route I saw scattered dead specimens, not yet eaten by sledge-dogs or by ravens.

It is a common tale among Greenlanders that the black guillemot sometimes winter under the ice, having a sort of chamber of snow on the surface of the ice above a small diving hole, like the birth chamber of the ringed seal. I never saw such cases, and although I have heard the story told in

the same manner from various parts of Greenland, I think that it can relate only to birds worn out in a snowstorm and frozen as in the instance of Brünnich's guillemot described above. I cannot understand that it is possible for any bird to keep its opening from freezing a longer time, even when it is burrowed under a layer of snow.

The Breaking of Breathing Holes by Narwhals

The ability of the whale to break breathing holes in the ice is a somewhat obscure point. At the first *savssat* I visited the holes, when first seen, were

Fig. 7—Points of 13 large tusks. The worn and polished white points, and the spiral grooves dark from algal growth, are clearly defined.

several feet long and from one to three feet broad. By lengthening and merging into each other, the holes first broken developed to cracks from six to eight yards in length. They formed a series distributed as groups of parallel openings, separated by intervals of ice intact for distances varying from fifty to a hundred yards (Figs. 3 and 4). Under the whole field of transparent ice small groups of the narwhal school, numbering from six to twenty animals, were constantly swimming to and fro, emerging now and then at the holes for breathing. It appeared to me that one of the foremost in the flock determined when the emergence should take place, the others following eagerly and crowding into the holes. At every emergence a dull rumble came from under the ice about the hole as if large tenpin balls had been thrown with great force from beneath up against the ice, and the ice we stood upon trembled considerably. I did not actually see new holes broken open, but I think I saw some holes enlarged. To be sure of this was

not easy, for with every emergence a great volume of water poured up through the hole. Since the cold was intense, about 30 degrees (centigrade) of frost, the water froze nearly instantly, and finally the holes became situated in the top of elongated ridges.

During the following days, the holes gradually narrowed by freezing. I once saw a hole used for breathing narrowed to a very small fissure without new breaking. Finally all holes of the first *savssat*, and most of the second, froze solid whilst other larger holes were made by the hunters for dragging up the carcasses. Towards the middle of March the ice had grown so thick that I do not think the narwhals were able to break it. At this time I noticed animals emerging for breathing in holes full of blood and flensing offal.

Use of the Narwhal's Tusk

The ice cakes broken by narwhals at the first *savssat* were about three inches thick, but at the second I measured some of six to seven inches in thickness (Fig. 4). Among the various conjectures made as to the probable use the male narwhal makes of his tusk, the view has been advanced and has found its way into textbooks of zoölogy that it is used to pierce openings in the ice. This suggestion must however be abandoned as quite wrong. The holes are broken by blows with the thick and firm cushion on the upper side of the head, in front of the so-called blowing hole, the exit of the nostrils. Eskimos at Godhavn and Skansen, well acquainted with the habits of the narwhal in ice, declare positively that the male carefully guards his tusk from bumping into firm and tough ice. Once Ludvig Geisler from Skansen found a single very large male sleeping near a lead in very hummocky ice, its mighty tusk projecting out over the surface of the ice and leaning against it. The animal awoke before Geisler could get his rifle clear and very slowly and cautiously drew the tusk back until it was quite clear, when it rapidly dived away.

In the drawing of G. Kleist (Fig. 5) illustrating the most ordinary form of *savssats*, may be seen a number of male narwhals emerging from a very small hole with their tusks resting upon the surface of the ice. Here a natural opening in the ice has gradually been diminished by freezing, and the stronger males have pushed off the weaker ones and the females. Eventually they become so worn out that they remain constantly at the hole, resting their tusks on the ice.

Holes Made by Other Whales

Whales of other species are also able to break breathing holes in ice. With white whales (*Delphinapterus leucas*) it is as common as with narwhals. Some natives state that the holes broken by white whales are somewhat trapeziform in shape and are thus distinguishable from those of the narwhals. Others deny this.

Giesecke mentions in his diary a case where a harpooned northern right whale ran with the line under the ice and broke ice that was over a foot thick. Old hunters relate numerous cases of a similar kind. The humpback whale (*Megaptera boöps*) has ordinarily left the waters of Disko Bay when the ice covering sets in. But sometimes it happens that a single straggler is delayed by the lure of unusually large schools of the polar cod (*Gadus saida*) and thus is surprised by the ice covering. It then breaks open large triangular or trapeziform holes.

THE GALAPAGOS ISLANDS*

By GEORGE McCUTCHEON McBRIDE

The Galapagos Islands, sometimes called "The Haunted Isles" (Las Islas Encantadas) and in 1892 officially renamed the "Archipiélago de Colón" in honor of Columbus, lie astride the equator, about 600 miles off the coast of Ecuador and 850 miles southwest of Panama.

Discovery

They were discovered in 1535, twenty-two years after Balboa first sighted the waters of the South Sea and three years after Pizarro had overthrown the Inca Empire. Tomás de Berlanga, third bishop of Panama, was the discoverer. While sailing from the isthmus for the newly conquered Peru, he was becalmed and carried by ocean currents far out from shore. Short of water and with the supply of feed for the horses on board almost exhausted, the navigators landed on an island toward which the ocean drift had carried them. They found little water or forage but saw great numbers of large land turtles (Spanish, *galápagos*) big enough to carry a man on their backs.

Names

The discoverers gave no name to the islands; but, because of the abundance of turtles found by subsequent visitors, the group soon came to be known among the Spaniards as the Islands of the Galapagos. Such names as Santa Gertrudis, Tierra de Carlos IV, Quita Sueño (nightmare), etc., were given to the individual islands. The archipelago was entirely uninhabited when discovered and remained so for 300 years. During the sixteenth and seventeenth centuries it was a favorite rendezvous of the buccaneers, who found the islands conveniently situated as a base from which to raid the Spanish towns of the west coast and to which they could return for the division of the spoils. These adventurers gave names of their own to the different islands, calling them after personages prominent in English history of their time; Chatham, Albemarle, James (Stewart), Charles (Stewart), Narborough, etc. Both former sets of names have been replaced by the Ecuadorian government, which has rechristened the group, using names of those connected with the discovery of America. So we find in official publications that the islands are now styled San Cristóbal, Santa

* The suggestion for this article came from an account of a voyage to the Galapagos Islands made in 1906-07 by Señor don Nicolás G. Martinez, formerly of the Observatory of Quito, Ecuador. This account was first published in full in 1916 in 23 numbers of *El Telégrafo* of Quito, two extracts having appeared previously in *La Prensa* of Ambato, Ecuador, in 1911 and 1913 respectively. Dr. John Kunst of Chicago, Ill., made a translation of the entire account and sent it with the translation to the Editor of the *Review*. It has been used in part as the basis for the present study.

María, Pinta, Pinzón, Isabela, Fernandina, etc. The English names, however, have persisted, and by them the islands are most widely known.

Early History

The first official exploration of the Galapagos was undertaken in 1793 by Alonzo de Torres of the Royal Spanish fleet. After a hasty visit to the islands, lasting only a few days, a map of the group was made.[1] As the Galapagos lay far off the routes followed by ships sailing the Pacific they were of little interest until the beginning of the nineteenth century. At that time citizens of the United States brought them to the fore. American whalers, having largely exhausted the Atlantic Ocean grounds, began to voyage farther in search of hunting fields. This was the period when the presence of their rich cargoes in the Falkland Islands offered a tempting opportunity to tax them, and it was only after an American man-of-war had destroyed the customhouse there that the attempt was given over. About this time the whalers began to round Cape Horn. Ports of Chile and Peru were now frequented by American whalers. Their harbors, where today the Stars and Stripes are seldom seen, were often filled with schooners carrying the American flag. These Pacific Ocean whale hunters found the Galapagos Islands a convenient gathering place. Sperm whales were abundant in the vicinity, and on these uninhabited islands food and fuel could be secured with little trouble. One of the harbors on the Island of Charles where drinking water (very scarce on most of the islands, entirely lacking on some) was found, still bears the name then given it, of Post Office Bay. There the whalers had arranged a place in which to deposit letters brought by vessels recently arrived or from which homeward bound ships could collect any mail left.

As Possessions of Ecuador

In 1831 an Ecuadorian, Gen. José Villamil, after investigating conditions in the islands, called the attention of his government to them, and the following year, apparently for the sake of securing revenue from the whalers or because of a fear lest an unclaimed group of islands which were assuming such importance might pass into foreign hands, Ecuador sent out a small expedition under Col. Ignacio Hernández, who, on February 12, called together the crews of the whaling ships then at the Island of Charles and in their presence formally took possession of the archipelago in the name of his government. A little colony was established near the harbor. A few acres were tilled though trade with the American whaling men was the main support of the colonists, who, in 1837, numbered some 200 or 300 people.

But the island soon was made a penal settlement, a step which destroyed all hopes of prosperous development; and by 1854, when Ameri-

[1] See J. A. Bognoly and J. M. Espinosa: Las Islas Encantadas, Guayaquil, 1905.

can whale fishing began to decline, the tiny colony had been reduced to a few members and extreme poverty. Distance from the seat of government, too, had made administration difficult. There had been frequent revolts. Two governors had been assassinated and one driven from the islands. Consequently when, in 1852, Great Britain proposed to accept the islands in lieu of a debt due from the Ecuadorian government there was little opposition in Quito. But Peru, France, and Spain protested against this

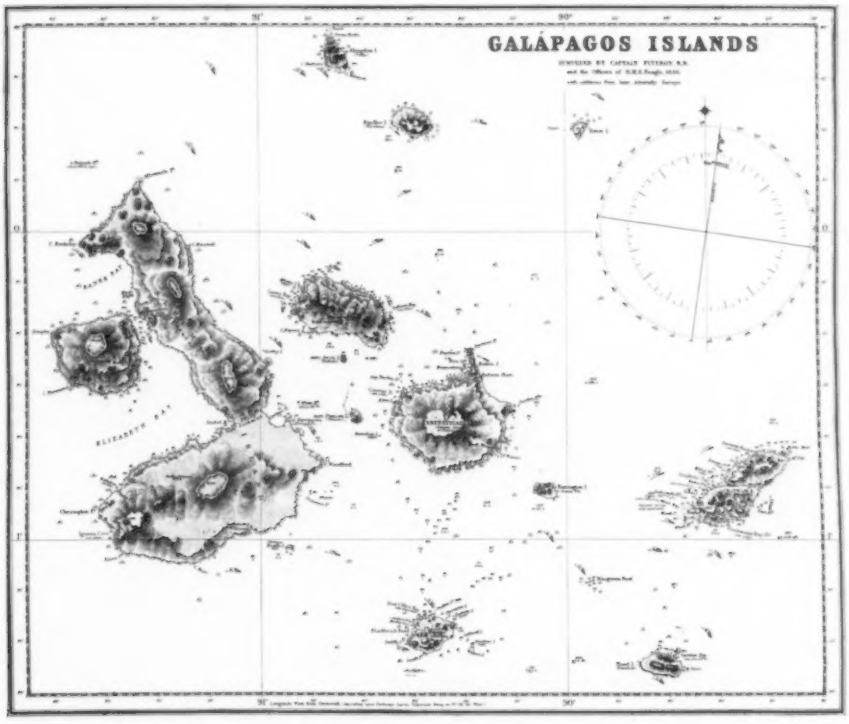

FIG. 1—Galapagos Islands: from the British Admiralty Chart, No. 1375, published 1886. Scale of this reduction 1:2,650,000.

transfer and negotiations came to nought. Just at this time an American whaling crew which had put into Post Office Bay were captured by the convicts and their ship employed as a means of escape to the mainland. The United States, in exacting damages in behalf of its aggrieved citizens, made an effort (1854) to secure a concession for the exploitation of the guano said to abound on some of the islands. This time England joined with the former obstructionists in blocking proceedings.

Once more, in 1858, the Ecuadorian government was said to have planned the lease of the islands to the United States in consideration of a loan of several millions of dollars. If such a project was considered it came to

nothing and the islands continued undeveloped and almost uninhabited. Former colonists had left many domestic animals which had grown wild and had increased rapidly. Droves of cattle, dogs, cats, pigs, and donkeys existed where the colonies had been, while flocks of goats occupied some of the lesser islands. Of later efforts at colonization none have succeeded except those now on Chatham and Albemarle. Recent unsuccessful attempts have been made by North American interests to secure concessions for the development of the natural resources, but the Ecuadorian government apparently fears that its hold on these distant possessions is too feeble to sustain the centrifugal influence of foreign colonists.

Visits of Scientists

The greatest interest in the Galapagos, however, attaches not to their history, but to the peculiarities of their geologic structure, their climate, and the unique place biologically which the group occupies. These have been the objects of attention by scientists from many lands and on repeated occasions. In 1835 when the *Beagle* visited the islands, the young scientist, Darwin, made a study of their natural history that has formed the basis of all subsequent work.[2] The Swedish botanist, N. J. Anderson, spent a few days on the islands in 1852. Later Dr. Habel, the scientists of the Hassler expedition under the direction of Louis Agassiz, Theodor Wolf[3] (as government geologist of Ecuador), Alexander Agassiz (as leader of the *Albatross* expedition), and others have investigated various phases of the natural history of the islands. The published results of these studies[4] and the accounts written by the buccaneers constitute almost the entire source of information regarding this peculiar group of islands.

[2] Narrative of the Surveying Voyages of H.M.S. Adventure and Beagle, 3 vols., London, 1839: reference in Vol. 2, pp. 484-505. Sir J. D. Hooker's work on the flora of the archipelago, based on Darwin's collections first drew scientific attention to its peculiar character (see B. L. Robinson, work cited in footnote 4, pp. 77, 81-82).

[3] Teodoro Wolf: Geografía y Geología del Ecuador, Leipzig, 1892, pp. 469-493; *idem*: Die Galápagos-Inseln, *Verhandlungen der Gesell. für Erdkunde zu Berlin*, Vol. 22, 1895, pp. 246-265.

[4] The more recent of these include:

Alexander Agassiz: General Sketch of the Expedition of the "Albatross" from February to May, 1891, *Bull. Museum Comp. Zoöl.*, Vol. 23, 1892, pp. 1-89, Cambridge, Mass.

George Baur: On the Origin of the Galapagos, *Amer. Naturalist*, Vol. 25, 1891, pp. 217-229: 307-326: *idem*: New Observations on the Origin of the Galapagos Islands, with Remarks on the Geological Age of the Pacific Ocean, *ibid.*, Vol. 31, 1897, pp. 661-680; 864-896.

Edmund Heller: Mammals of the Galapagos Archipelago, *Proc. California Acad. Sci.*, 3d Ser., *Zoölogy*, Vol. 3, 1904, pp. 233-250.

A. L. Kroeber: Floral Relations among the Galapagos Islands, *Univ. of California Publs. in Botany*, Vol. 6, 1916, No. 9, pp. 199-220.

Robert Ridgway: Birds of the Galapagos Archipelago, *Proc. U. S. Natl. Museum*, Vol. 19, 1897, pp. 459-670.

B. L. Robinson: Flora of the Galapagos Islands, *Proc. Amer. Acad. of Arts and Sci.*, Vol. 38, 1902, pp. 77-269.

Alban Stewart: A Botanical Survey of the Galapagos Islands, *Proc. California Acad. Sci.*, 4th Ser., Vol. 1, 1911, pp. 7-283: *idem*: Further Observations on the Origin of the Galapagos Islands, *Plant World*, Vol. 18, 1915, pp. 192-200.

See also the chapter on the Galapagos Islands in R. F. Scharff: Distribution and Origin of Life in America, New York, 1912, pp. 295-335.

Volcanic Character

The Galapagos Archipelago is composed of ten principal islands with many smaller ones. The largest, Albemarle (Santa Gertrudis of the Spaniards, Isabela of the Ecuadorians), measures about 75 miles in greatest length by 15 in maximum width. Some of the smaller ones are mere rocky points projecting above the surface of the water. Wolf estimates the space over which the islands are scattered as some 18,000 square miles and their combined area is a little over 2,000 square miles. There is a striking similarity in the appearance of the larger members of the group. Each island is composed of one or more central cones from which the land slopes gently to the water's edge except on the southeast side where the ocean waves, breaking constantly against the shore, have worn it back into abrupt cliffs. The summits of the islands vary in height from 1,000 to nearly 5,000 feet. Seen from a distance these higher points rise as if from separate bases, the low connecting flats appearing only on near approach. Scattered over the sloping plains from the shore to near the inland summits rise thousands of jagged secondary peaks, roughly conical hillocks, that impart a strange appearance to the landscape. The whole group is volcanic. Darwin believed that the islands were entirely oceanic in origin and that each had risen separately. This theory, supported by Wallace and Agassiz, was undisputed for many years; but Baur's study of the biology of the islands led him to the conclusion that they had formerly been joined together and at a still earlier period had been connected with the American continent.[5] The survey of the ocean topography between Central America and the Galapagos carried out by the *Albatross* expedition in 1885-91 showed the islands to be the highest points of a submarine elevation, more or less circular in form, sloping up very gradually from 1,000 fathoms below the surface. This elevation in turn is the summit of an immense submerged plateau that extends northward past Cocos Island almost to the Isthmus of Panama.[6]

The entire surface of the islands is covered with lava and volcanic ash ejected from craters in the central and secondary cones. Colnett, who visited them in 1794, speaks of Albemarle and Abingdon as "one entire clinker."[7] Over the lower lands the lava shows little effect of weathering; the plains are covered with brittle fragments; and the surface is crossed at intervals by huge streams of glassy blocks of obsidian as fresh as if just cooled. As animals cross these fields or pick their way among the knife-like edges of broken rock their hoof beats resound as on a metal pavement. On the upper slopes the lava is badly decomposed, forming a rich, though shallow, soil.

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[5] See the discussions of the problem in the several works referred to in footnote 4.

[6] Alexander Agassiz: Work cited in footnote 4, pp. 9-11.

[7] James Colnett: A Voyage to the South Atlantic and round Cape Horn . . . . London, 1798; reference on p. 143.

Eruptions

There have been several eruptions recorded since the time the islands were discovered. In 1814, again in 1825, and again ten years later volcanic activity was noted in some of the western islands. In 1897 a new crater, on James Island, broke into violent activity, pouring enormous streams of lava down the mountain side. At times a glow may still be seen reflected from the opening made on that occasion. Though there has been no eruption observed on Albemarle for many years, the crater of Santo Tomás, one of its largest cones, contains many vents from which are constantly issuing jets of steam and gas. Other islands are deeply covered with flows of recent date. Wolf asserts that even the base of the islands is composed of an old volcanic tufa. Though sandstone had been reported along some of the coasts Alexander Agassiz determined this to be only decomposed fragments of coral cemented into rock. Coralline limestone is seen in places on the beach though no reefs are present nor do corals thrive in the surrounding waters, which are too cool to favor their existence. Deep sea dredgings have revealed an immense amount of silt that has been carried far out toward the Galapagos, an occurrence which also probably has served to check the growth of corals in this region.

Plant and Animal Life

Conclusions regarding the origin of the islands are based as much upon the nature of the plant and animal life found there as upon the geologic structure of the group. To the traveler, unless fortunate enough to arrive during an unusually rainy season, the general aspect is weird beyond imagining.[8] Save for a narrow belt of mangrove trees that in places fringe the shore there appears nothing but a broad reach of jagged volcanic rock, its barrenness broken only by solitary stalks of tall, forbidding cactus, or scattered clumps of stunted, ash-colored shrubs whose leaves have shrunk to desert thorns. The few varieties of animal life encountered in this desert zone are no less strange. Sun-bleached shells of giant turtles dot the plains; occasional living specimens may be seen feeding upon the succulent cactus stems. Birds of a limited number of species, so tame they may be caught in one's hands or knocked down with a stick, swarm like flies within the belt of mangrove trees or sweep over the black plains in search of insects. The most common animal is the lizard, the small familiar kinds that dart from crevice to crevice among the rocks, the larger land variety generally found in caves among the blocks of lava, or the great, hideous, sea iguanas, some three or four feet in length, notable as being the sole surviving species of marine saurians from a bygone age. The entire scene is typical of the storied desert island: a fitting site for pirates' rendezvous; well named "The Haunted Isles."

[8] Agassiz (whose visit in 1891 occurred during a year of famous rains on the islands and the corresponding mainland) remarks the contrast between the then green appearance and the desolate aspect described by Darwin (*op. cit.*, p. 61).

The Interior Region

Going inland, across the barren plains one encounters a region in striking contrast to the arid coastal lands. The ground rises gently toward the interior. At about 500 feet above sea level there occurs a sudden change of conditions. The desert gives way to a flourishing growth of vegetation. Only a narrow belt of larger but still leafless trees marks the transition to this upper zone. Here a thick growth of forest is encountered, composed of trees not large but having an exuberant foliage, while creepers cross from tree to tree, and the ground is overgrown with beautiful ferns.

Above this forest belt and reaching, on some of the islands, to the extreme summits of the rounded cones extends a stretch of grasslands where herds of wild cattle and donkeys graze and fatten. Here too live giant galapagos, on islands where inroads of hunters have not exterminated them. The soil of these natural pastures is a clay, formed, as has been said, of lava decomposed by constant moisture and enriched with a deposit of humus that makes possible an abundant growth of grass; or, as on Albemarle, a surface bed of finely powdered pumice, which, though too porous to retain much water, has offered a foothold for the formation of a compact sod. Running water is scarce even upon these pasture lands; but the water table lies only a little below the surface, and drinking places have been excavated where the lay of the ground permits or where tiny springs emerge. To these drinking ponds the animals come from great distances. The cattle are able to go an unusually long time without taking water. The heavy mists that settle on the grass seem to supply their need. The turtles, also accustomed to drink but seldom, travel for miles to slake their thirst about the borders of the pools. With their slow pace they spend many days in reaching the water. After drinking their fill they lumber back to their wonted feeding grounds along the well-worn paths that radiate from each pond.

Effect of Isolation on Organic Life

Of all the islands in the world none offers a better field to study the distribution of plant and animal life or the effect of an isolated environment upon organic forms. Of the 26 kinds of land birds described by Darwin all but one were peculiar to the Galapagos, while nearly 200 of the 400 species of plants that have been found are confined entirely to this group of islands. The great land turtles exist in no other place upon the globe. Here alone survives that strange saurian, the sea iguana to which reference has already been made. Only one species of native mammal has been found, a small rodent, likewise endemic, about the size of a rat. So distinct are both the fauna and the flora and so diverse on the different islands that they point to a long period of isolated development whatever the source from which they came.

Probable Origin of Flora and Fauna

The conclusions arrived at by Darwin and confirmed by Alexander Agassiz have been borne out in later research, that "its flora . . . . . is eminently American, while its fauna at every point discloses its affinity to the Mexican, Central, or South American, and even West Indian types."[9] In spite of the distance that separates them from the mainland the Galapagos Islands are well situated to receive contributions of plant and animal life from the continents. They lie at the meeting place of two ocean currents, both of which come directly from coasts that might contribute to this life. The Humboldt Current, during nine months of the year when the trades are blowing constantly, divides into two branches off the coast of Ecuador, the larger one veering westward towards the Galapagos. Its velocity is very great, sometimes as much as 75 miles a day; so that under favorable circumstances eight or ten days would suffice to carry drifting objects to the islands. From the northeast a warm current that has come down along the coast of Central America enters this same region. The meeting of the different streams produces what has been called "current doldrums," the current turning east or west, north or south, according to the direction of the wind. The fact that the current from the southeast is cold and that it flows along a desert coast where few streams enter the sea, while the northern current has a higher temperature and bathes a shore whose numerous torrents in the rainy season come laden with sediment, probably accounts for the greater resemblance of fauna and flora to those of Central America. The *Albatross* observers reported the ocean floor covered with decaying vegetable matter far out along this northern drift. This seems sufficient to explain the presence and the character of life upon the islands without presupposing a former actual land connection. Alban Stewart, after a year spent on the islands and a careful study of their flora, considers that the botanical evidence goes so far as to make a very positive argument against any former connection with the continent.

Climate

The climate of the Galapagos is far from equatorial. The presence of cold water from the Humboldt Current reduces still farther the mild temperature to be expected in an oceanic climate. Darwin reported a temperature of 60° F. one foot below the surface on the southeast side of Albemarle, and Wolf records surface temperatures of 70° F. and 73° F. at several points between the islands. So marked is the effect of the cold current that, while the geographical equator passes directly through the group of islands the thermal equator lies some distance north, throughout many months departing over 20° of latitude from the geographical line.

[9] Alexander Agassiz: *op. cit.*, p. 60.

This favors the development of strong southeast trades at the islands during most of the year. A further contributing influence to the cool temperature of the ocean in this region is probably found in the upwelling of cold water from the ocean depths.[10] These factors combine to make the Galapagos cooler than any other equatorial land at so near sea level. Even on the lowlands the heat is modified, but the effect of air currents from off a cool water surface is most striking as one ascends the slopes toward the interior.

The zones of vegetation already noticed find their explanation in the varying meteorological conditions that exist at different levels. Both in temperature and moisture is this difference notable. Though continuous records are lacking, the observations made by scientists at different seasons of the year give a fairly accurate idea of the climate. While near sea level the temperature often rises to 90° F. (even higher in places sheltered from the wind), Wolf found a fall of one or two degrees for every hundred meters of ascent. Upon the middle slopes some 400 to 600 feet above the sea the average temperature was less than 70° F. On the summit of the hill of San Joaquín in Chatham Island at an elevation given as 2,330 feet, he recorded a mid-day temperature of 57.2° F. during heavy mist and a strong southeast wind. There is little variation from day to day and no marked seasonal difference. A passing cloud, or the presence of a fog, produces greater change of temperature than do the seasons, while the greatest range occurs from day to night. After sundown it becomes actually cold on the higher hills, and travelers who pass the nights there in the open air huddle about their camp fires even during the milder months of the year.

The northern islands lie more within the influence of the warmer ocean waters from the Gulf of Panama, those toward the south receiving the full effect of the cold Humboldt Current. The low temperature of the ocean waters has made possible the occurrence of some forms of life rarely found outside the higher latitudes. Several kinds of seals are common, among them *Otaria australis*, found also on the coast of Peru and Chile and about the islands of Tierra del Fuego. Penguins, whose range is generally restricted to the coast of subpolar regions, are here found directly upon the equator; and the great albatross so common about Cape Horn has followed the cold current towards the north, nesting by hundreds upon the island of Hood.

Rainfall and Moisture

In amount of moisture the zones of elevation are still more marked. The lower levels are almost rainless. During the first four months of the year some showers may fall, but completely rainless years are not unknown. The nature of the soil is such that any water which may fall immediately disappears beneath the rock-strewn surface. Some who have visited the

[10] Cf. R. E. Coker: Ocean Temperatures off the Coast of Peru. *Geogr. Review*, Vol. 5, 1918, pp. 127-135.

islands in unusual seasons have been surprised to find the lower lands green with vegetation; but in normal years there is a very serious lack of moisture.

In contrast with the desert conditions characteristic of the slopes near the sea, the uplands are bountifully supplied with moisture. Besides a well-marked period of frequent convectional showers extending from February to May when the southeast trades are interrupted and equatorial calms prevail, there is a so-called summer, approximately from June to January, when, though the tropical downpours have ceased, the hills are drenched in dense mists (*garúas*) sufficient to keep the roads filled with mud, make books and papers mold in a short time, and quickly rust unpainted iron. Light rains may fall here at any season. On the southeast side of the islands, as on corresponding slopes of the hills, the moist zone extends several hundred feet lower, while the northern exposures, sheltered from the rain-bearing winds, present a striking contrast in their relatively arid character. The effect of abundant moisture on the uplands is evident not only in the ranker growth of vegetation but even upon the lava flows that stretch from near the summits to the sea. The upper sections of these flows are often badly weathered and covered with plants that have found lodgment upon their surfaces, while the lower reaches, that cross the arid zone beneath, show little effect of atmospheric action but lie in solid blocks of black obsidian. But for the constant humidity on the highlands the soil itself would still resemble that of the desert lower grounds.

Settlements

It is upon these high slopes that the few human settlements have been made. Only laborers required to handle cargoes live beside the landing places. On the island of Charles (Santa María of the Spaniards, Floreana of the Ecuadorians) Darwin found a penal colony occupied in the cultivation of corn, sugar cane, fruits, and many vegetables. The *hacienda* on Chatham island produces chiefly sugar, but its peon workmen raise also coffee, grains, and fruit. Hides and turtle oil, with sulphur from the crater of a volcano, form the principal products of the one estate on Albemarle. Its people are well supplied with beef or turtle meat and raise enough to provide for their own needs on the small patches of cultivated land. No other islands have been occupied. The lower ones possess no productive soils. There is estimated to be a total of about 200 square miles of land suitable for cultivation on all the islands. A somewhat greater area is available for pasture. The climate is found congenial by the Indians from the highlands of the Andes. They form the principal element in the population of Chatham, serving as peons upon its sugar estate. The only land occupied is held in these two large farms on Chatham and Albemarle. About them centers the entire life of the islands. Their respective owners

hold a monopoly of the trade; to them belong the only vessels plying between the islands and the mainland. Ecuadorian officials, desirous of seeing the islands peopled by their own citizens, propose to grant free land to prospective settlers, advancing funds sufficient to equip them with the necessary implements for farming.

Prospects

The Galapagos are not likely to become a purely agricultural colony. The restricted area of tillable soil makes that improbable. Other resources, however, may be developed. The giant turtles will supply oil and meat for a few inhabitants for some time to come. Their flesh is tasty. Dampier said of them, "they are large and fat, and so sweet that no Pullet eats more pleasantly." For this very reason they are already extinct on Chatham and would not long survive the general settlement of the islands. Contrary to what has been supposed there is little guano worth exporting and no metals can be expected, considering the volcanic structure of the rock. But stock raising and exploitation of such resources as sulphur, orchilla (the lichen producing the dye orchil or archil), and the marine life with which the ocean teems and which may be cured with the salt deposits of the islands, may supplement agriculture sufficiently to make a considerable population possible.

With the opening of the Panama Canal the islands gain an advantageous position. Their situation, once an obstacle to all progress, now becomes a valuable asset. Directly on the line of traffic from the Isthmus to New Zealand and Australia they offer an excellent site for coaling and provision stations.[11] Several well sheltered harbors on the western side of the islands are of easy access and afford good anchorage for vessels. While the currents are baffling and uncertain, no storms visit the group during any period of the year. The scarcity of water may be overcome. Though few surface streams have been discovered water can be found at little depth on the larger islands and some streams are known to enter the sea below the high tide level. Though it may be a consideration of little weight while they remain the property of Ecuador, the islands possess, too, great strategic importance because of their nearness to the world's new crossroads. In the hands of a naval power they would become of value as a base from which to guard the approaches to the Canal. But Ecuador seems reluctant to part with them and, in the hope of effecting their colonization and by maintaining closer intercourse with them, no doubt plans to profit from their enhanced importance along the coming lines of trade.

[11] Paul Walle: Les îles Galapagos et le canal de Panama, *Bull. Soc. de Géogr. Commerc. de Paris*, Vol. 33, 1911, pp. 594-604.

THE REAL TEMPERATURES THROUGHOUT NORTH AND SOUTH AMERICA

By MARK JEFFERSON

What a suggestion of burning heat has the phrase "torrid zone" and how unwarranted! And how pleasing is the name "temperate" applied to our own zone! Well do we know the fierce heat of our summer hot spells, the bitter cold of our winter cold waves; well have we in mind the sudden rises and yet more sudden drops that characterize the temperatures in this zone that is temperate in name but so intemperate in fact that the only sound description of it that applies at all times is that every season is exceptional: the summer is the hottest or the coolest, the driest or the wettest, the winter is the mildest or the most severe in the memory of the oldest inhabitant!

Tropical Uniformity vs. Temperate Changeability

The present collection of diagrams attempts to set forth the facts of the actual temperatures in all America, almost from the Arctic to the Antarctic (Fig. 1), by showing the afternoon heat and the nightly cooling day by day throughout the hottest month and the coolest month of a whole year. For a good many places the year is 1904.

On examining these diagrams we shall see that regularity, monotonous recurrence of a fairly constant change from warm days to less warm nights, is the characteristic of tropical temperatures, and that changeability, incessant alternation of stimulating spells of heat and cold, characterize our temperate zone. It is not true that our weather is more temperate than tropical weather. It is not true that the equator is the hot belt of the earth. It is not true that the temperature régime of all the zones may be found in the torrid zone on ascending from the lowlands to the lofty mountain heights. Our weather is intemperately changeable. The world's greatest heats are encountered along the borderland between temperate and torrid zones. Each level in the mountains of the torrid zone is characterized by monotonous repetition of one set of temperature oscillations—among lower and lower temperatures at higher and higher altitudes, it is true, but quite without the sudden changes or even the contrasts between summer and winter temperatures that mark the temperate and polar zones. The night is the winter of the tropics, recurring with very little difference 365 days in a year, whether it be from days between 75° and 90° to nights between 60° and 75° beside the Gulf of Mexico at Havana, or days between 20° and 30° and nights between 7° and 20° at the summit of El Misti, 19,000 feet above the waters of the Pacific, near Arequipa, Peru.

Attention was called in the pages of this publication[1] several years ago

[1] Mark Jefferson: The Steady Warmth of the Tropics, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 346-348.

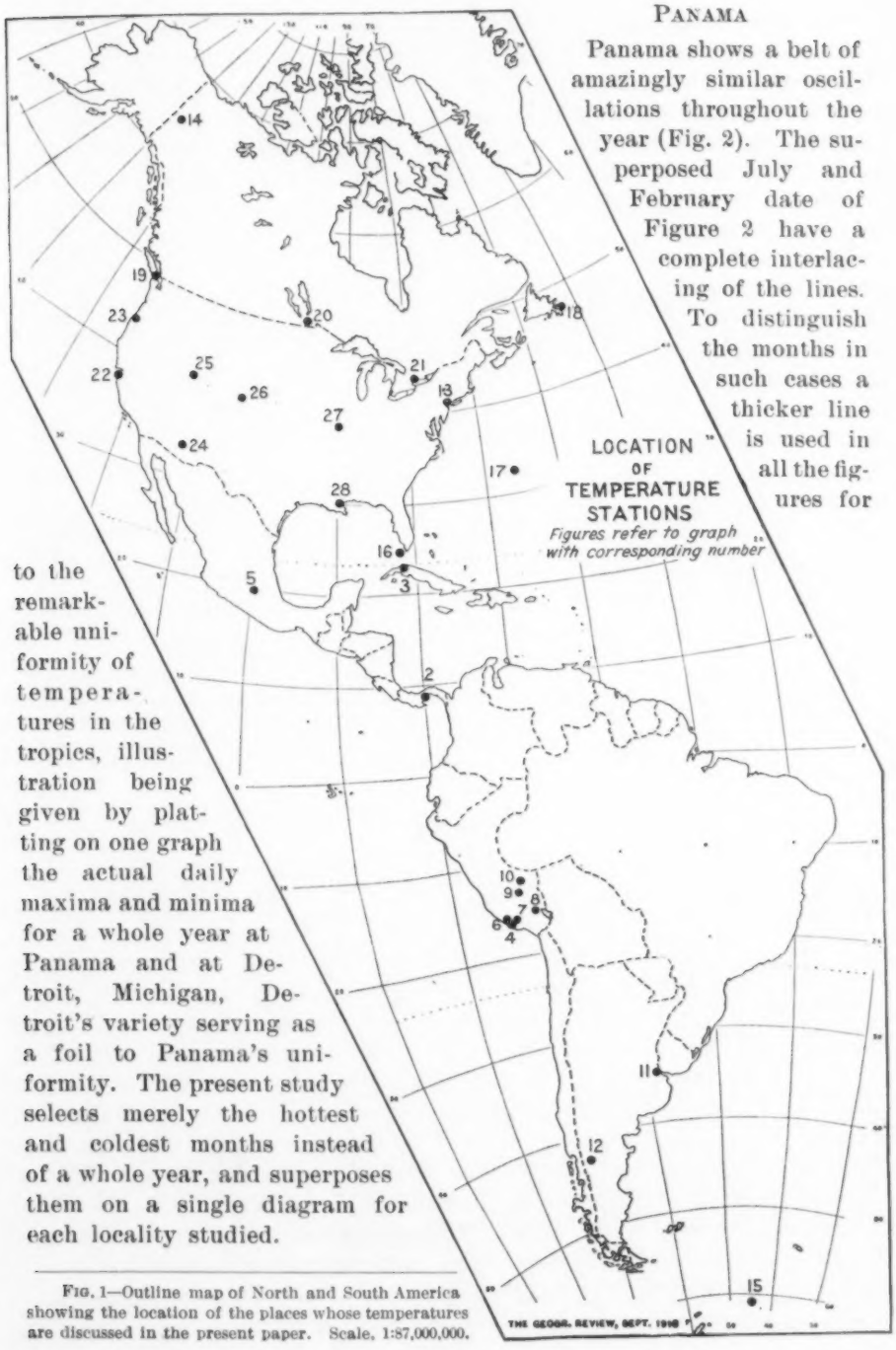

FIG. 1—Outline map of North and South America showing the location of the places whose temperatures are discussed in the present paper. Scale, 1:87,000,000.

PANAMA

Panama shows a belt of amazingly similar oscillations throughout the year (Fig. 2). The superposed July and February date of Figure 2 have a complete interlacing of the lines. To distinguish the months in such cases a thicker line is used in all the figures for

to the remarkable uniformity of temperatures in the tropics, illustration being given by platting on one graph the actual daily maxima and minima for a whole year at Panama and at Detroit, Michigan, Detroit's variety serving as a foil to Panama's uniformity. The present study selects merely the hottest and coldest months instead of a whole year, and superposes them on a single diagram for each locality studied.

the warmer month. The February mean temperature at Panama is 80.8°, that of July 81.1°. So far as temperatures by the thermometer are concerned one cannot tell the hottest month of the year from the coldest, though as July is a month of the rainy season the humidity doubtless makes the *sensible* temperature—with which we are not here concerned—much hotter. But one swallow does not make a summer, and Panama may not be perfectly typical of tropical lowlands. What are the facts for Havana, for instance?

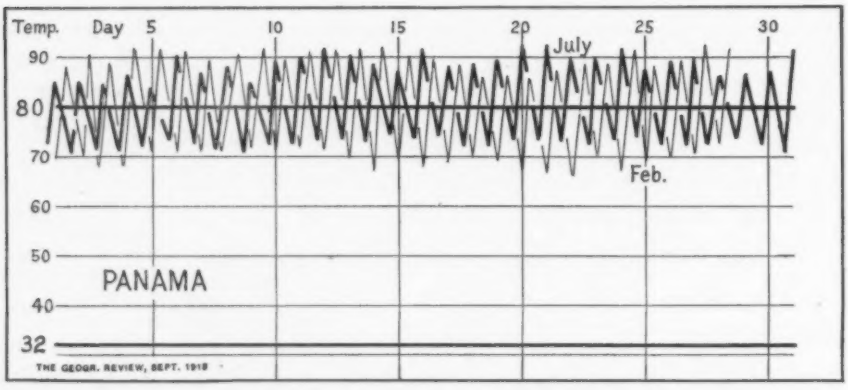

FIG. 2—Daily maximum and minimum temperatures at Panama in July and February, 1913.

July:	mean	81.1°;	range	16°;	variability	1.2°;	rainfall	4.85 ins.
February:	"	80.8°;	"	19°;	"	1.7°;	"	0.22 ins.

Throughout the graphs, Figs. 2-28, the heavier curve represents the warmer, the lighter the colder month. The upper points of the curves represent the day-time, the lower points the night-time temperatures. The mean temperature of each of the two months shown is indicated by a broken horizontal line (not shown on this graph). The 80° and 32° lines are emphasized as representing the lower and upper limits respectively of temperatures termed in this paper *hot* and *cold*.

HAVANA

August is the hottest month and January the coldest (Fig. 3). There is still a great deal of steadiness, especially in the hotter weather. Havana is about 23° north of the equator, over twice as far as is Panama. The summer sun is well-nigh overhead, while in January it is halfway down to the southern horizon. January is distinctly cooler than August, in the mean 13° cooler. In actuality August afternoons range from 87° to 92°, and January ones from 69° to 82°. The nights in August range from 69° to 76°, in January from 52° to 65°. August is easily distinguished from January by greater warmth and much greater steadiness of temperature, though the irregularities of winter are not strong enough to make much difference. The nearest approach to a "spell of weather" is the last seven days of the month, with nights at 66° and days about 81°.

Two dark lines drawn on all these diagrams at 80° and 32° serve to compare temperatures from place to place. Arbitrarily it is proposed to call temperatures above 80° *hot* and those below 32° *cold*. This will give us a precise phraseology that is very convenient and not wholly without reason.

If we care to discriminate further we may call it *cool* between 50° and 32°, *mild* between 68° and 50°, and *warm* between 80° and 68°.

Accordingly, in August, days in Havana are hot and nights warm; February nights are mild and days warm. In Panama, on the other hand, days are hot and nights warm at all seasons. It is especially interesting to note that days in the high 90's and 100's with nights in the 80's, as in

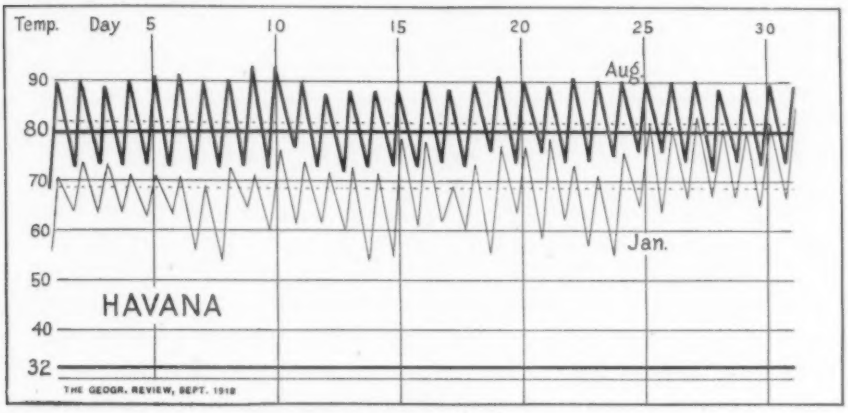

FIG. 3 (year: 1902).

August: mean 81.8°; range 16.4°; variability 0.9°
January: " 68.2°; " 14.2°; " 2.8°

Chicago, July, 1916, occur only in the temperate zone. In the tropics they are unknown.[2]

MOLLENDO

A third tropical locality, close to sea level, like the first two, is Mollendo, 17° south of the equator on the Peruvian coast (Fig. 4). Mollendo shows the same tropical type of weather. February is the hottest month, as we are now south of the equator, and July one of the coolest. But Mollendo differs from both of our previous tropical examples in having no hot days. Warm days and nights are characteristic of February, mild days and nights prevail in July. Both Panama and Havana stand beside seas whose surface waters have a temperature of 80°, Mollendo beside waters at about 70°.

VARIABILITY AS A CRITICAL FACTOR

The reader should not miss the note of actuality in these diagrams. He reads instantly here the highest afternoon temperature that occurred in the year indicated on any and every day of the hottest month and of the coolest month. On the 9th or the 17th, or whatever day you will, the

[2] The nearest approach to this condition is in dry continental interiors: e. g. Fort Archambault (Shari River, central Africa, lat. 9° N.) had in April a mean maximum of 100° and a mean minimum of 75.4°; Daly Waters (northern Australia, lat. 16½° S.) in January, 1912, a mean maximum of 102.7° and a mean minimum of 76°.

thermometer went so high or fell so low. The mind imagines the clothing suitable for street wear, what bedding would be agreeable at night. Average temperatures can never serve as a basis for such ideas. Yet a use may be made of averages to get a measure of the variability, which, it should be emphasized, is characteristically low in the tropics and high with us. For this purpose the average temperature of the whole day, roughly

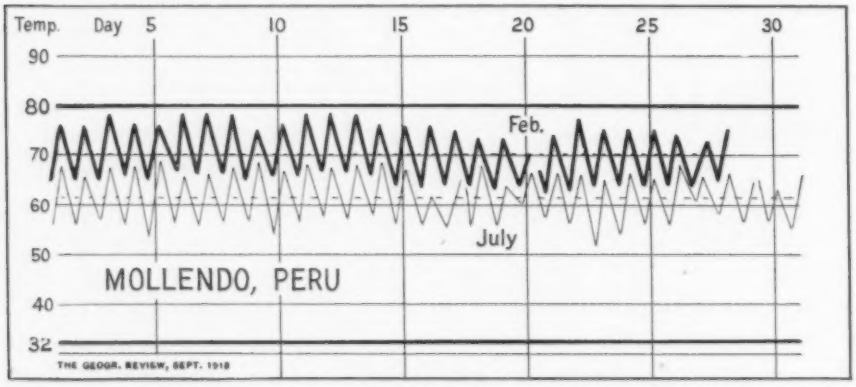

FIG. 4 (year: 1895)
February: mean 70.3°; range 11.0°; variability 1°
July: " 61.6°; " 10.4°; " 1°

expressed by the half-sum of the day's maximum and minimum temperatures, is compared with the mean temperature of the whole month, as derived from the sum of all the maxima and minima divided by twice the number of days in the month. At Panama no day of either month shown has a mean temperature that differs more than 3° from the mean of the month. The average difference of all the July days from the mean is 1.2°; of the February days 1.7°. For Havana the mean variations of daily and monthly means are 0.9° for August and 2.8° for January. No single day of August at Havana varies more than 3° from the mean of the month. The more variable January, however, has nine days each of which is more than 5° warmer or cooler than the monthly mean. Mollendo has a mean variability of 1° in both February and July; neither month has a single day of mean temperature 5° different from the mean of the month.[3]

TOLUCA, MEXICO

In tropical America great human interest attaches to the highlands on account of the long-continued occupation of the lofty Mexican and Andean

[3] This variation of the mean of the days from the mean of the month must not be confused with the daily range of temperature—the difference between the maximum and minimum for the day. The variability may be very small indeed while the daily range of temperature is very large. For that it is only necessary that the same large daily oscillation of temperature be repeated with great steadiness day after day. The cooler month at Arequipa on Fig. 7 is a good example of great daily range and small variability. It should also be remarked that this expression of variation is not the same as that ordinarily described by the meteorological term "mean diurnal variability," which is the average of the temperature differences between successive days.

plateaus by native races who had attained the highest culture of all American peoples. Figure 5 gives the graph for Toluca, capital of the State of Mexico, 40 miles west-southwest of Mexico City, for December, 1902, and April, 1903. Ordinarily May is one degree warmer than April, but it was not so in 1903. Toluca, in latitude 19.3° N., is well within the tropics and 8,810 feet above the sea. Its temperature shows the same tropical steadi-

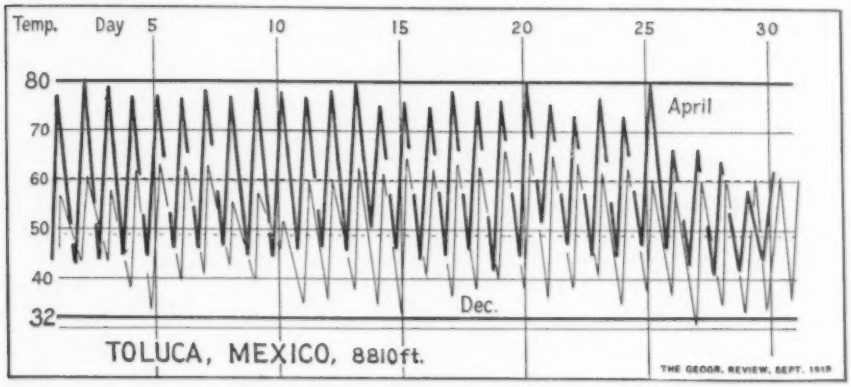

FIG. 5 (year: April, 1903, and December, 1902)
April: mean 60.0°; range 30°; variability 2.5°: rainfall 0.70 ins.
December: " 49.5°; " 23°; " 1.8°; " 0.53 ins.

ness as the three previous graphs. Expressed quantitatively, the mean variability of temperature for April is 2.5°, for December 1.8°. April had one day differing 10° from the mean and four differing from it by more than 5°. December has a single day differing more than 5° from the mean. Further, Toluca had no *hot* day and no *cold* day. Warm days with nights mild to cool characterize April, and mild days with cool nights December.

MAINTENANCE IN THE TROPICS OF UNIFORMITY OF RÉGIME WITH INCREASING ALTITUDE

These are the most temperate temperatures in the world. It is to be noticed that the only change that has accompanied the elevation nearly two miles into the air is a change of the *pitch*, so to say, at which the temperature scheme is developed. We have got no winter by going up from sea level, but merely the same steady tropical oscillation among cooler temperatures. There is still the same monotonous daily swinging of the thermometer between limiting values that are almost fixed. We shall see below that real winter consists not merely of cold weather, but of cold weather strongly differing from a season of summer and highly variable in itself. A wire bent into the shape of the Panama graphs and laid along the 80° line of our temperature frame represents the temperatures of tropical lowlands. To represent the facts for various heights in the tropics, we have only to place the wire at lower levels on the diagram.

The increase in the daily range of temperature is local and not dependent on the height alone. More will be said of that later. But no position of such a wire can correspond to real winter.

Peruvian Highland Stations

We are fortunate to have means of illustration in the admirable work of the Peruvian Expedition of Harvard University.[4] A series of seven stations that will serve our purpose is found there. The observations were made for a very brief time, rarely much more than a year or two, by volunteer observers, but they are of the greatest interest because of their location.

	Elevation	*Latitude*	*Longitude*
Mollendo	Sea level	17.1° S.,	72° W.
La Joya	4,140 feet	16.8° S.,	72.2° W.
Arequipa	7,550 feet	16.4° S.,	73.1° W.
Vincocaya	14,360 feet	15.7° S.,	71.2° W.
Cuzco	11,100 feet	13.5° S.,	72° W.
Santa Ana	3,400 feet	12.5° S.,	73.2° W.

La Joya and Arequipa are on the western slopes of the Andes, Vincocaya on the summit of the Andean plateau, the ancient city of Cuzco in a sheltered valley sunk in the plateau, and Santa Ana "well beyond the eastern Cordillera near the limits of civilization; the valley is broad and bounded on the east and west especially by hills of moderate elevation."[5]

La Joya

In Mexico the hot month was 11° warmer in the mean than the cold one. At La Joya (Fig. 6) the warm month is but 8.5° warmer than the cold

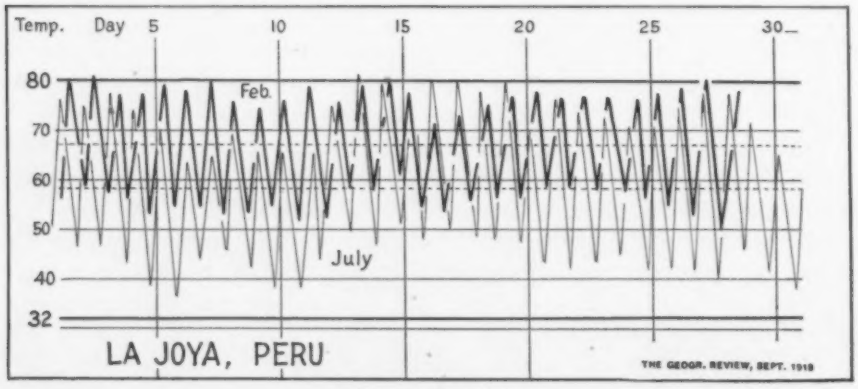

Fig. 6 (year: 1894)

February: mean 67°; range 22°; variability 1.4°: cloudy days 22
July: " 58°; " 28°; " 3.3°; " " 9

[4] S. I. Bailey: Peruvian Meteorology, *Annals Astron. Observ. of Harvard College*, Vols. 39 and 49, Cambridge, Mass., 1899 and 1906; 1907 and 1908.

[5] *Ibid.*, Vol. 39, Part II, p. 162.

one. The striking feature of temperature here is that the daytime heats are so little different in the hottest and the coldest months, while the July nights are fully 10° colder than those of February. The range of temperature in the colder month was much greater, 28° in mild July and 22° in warm February. This difference was due to clouds. There were 21 or 22 cloudy days in February and but 7 or 8 in July. Both months had warm afternoons; but in February the nights were all mild, in July all cool. The mean variation of February days from the average temperature of the month was 1.4°, of July days 3.3°. No February day had a mean differing so much as 5° from the monthly mean. July had one day that differed by 10° and ten that differed by more than 5°. Like Toluca, La Joya had no hot temperatures nor cold ones, though it is little more than half as high above sea level.

Arequipa

Arequipa (Fig. 7) is nearly as high above the sea as the Mexican city, and its temperatures are very similar. In Arequipa it gets neither hot nor

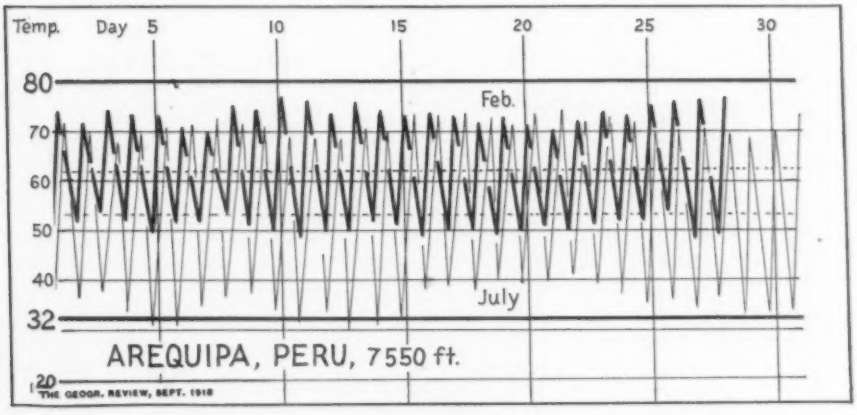

Fig. 7 (year: 1889)

February: 62.2°; range 23°; variability 0.8°; rainfall 0.08 in.
July: 53.5°; " 36°; " 1.8°; " 0.00

cold. Its temperature régime is strictly tropical, no day varying by 5° from the monthly mean; and the average variabilities of the warm and cold months are 0.8° and 1.8° respectively. Toluca had 2.5° and 1.8°. The mean temperatures of Arequipa's two months are 62° and 53.5°. Toluca had 60° and 49.5°. Arequipa's hottest temperature was 77° and its coldest 30°. Toluca had 80° and 31°. The daily range of temperature at Arequipa is 23° and 36°. Toluca had 30° and 23°. Still more exactly than at La Joya the afternoons at Arequipa reach about the same temperatures in the hottest and coldest months, but the nights of the cold month run much colder than the nights of the warm month. Warm days and mild nights characterize

the warmer weather, and warm days and cool nights the coolest. There is nothing of winter in all this. The rainfall of February was 0.08 inch. In July there was none at all. The cloudiness of both months was reported a little over 5 on a scale of 10 for the year 1889, but for the four years 1892-95 the cloudiness averaged about 5 in February and in July 2.7, the daytime clouds cutting down the February maxima.

VINCOCAYA

Vincocaya is on the great shivering Andean tableland, at 14,360 feet above the level of the sea. The régime is still tropical (Fig. 8). November is now the warm month, averaging 4° warmer than any other. June was

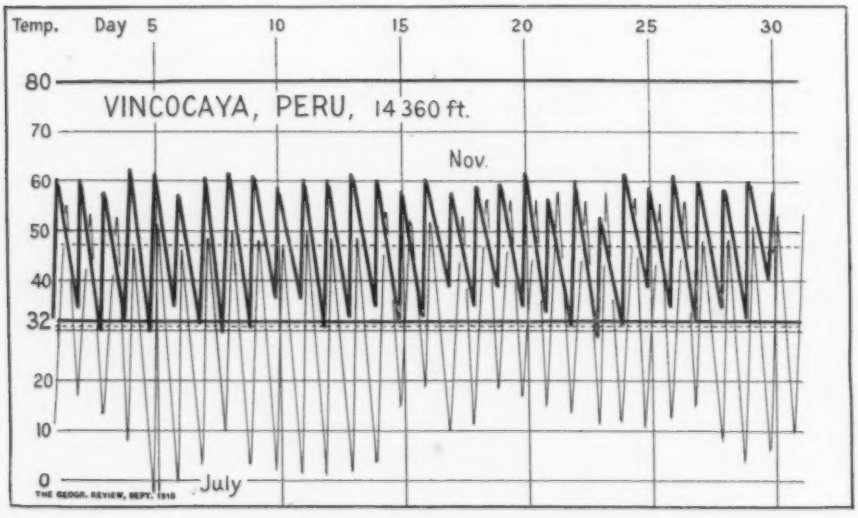

FIG. 8 (year: 1889)

November: mean 47°; range 26°; variability 1.3°; rainfall 0.54 in.
July: " 31°; " 43°; " 3.7°; " 0.00

reported 0.2° cooler for the year 1889, but July may serve us, as we have its data. All the characters first described for Arequipa are seen again here. November days are mild, and the nights cool. July days are mild, and the nights cold. But this is not winter. The temperature is rarely above 60°. In the shade one is cold at all hours and at all seasons, but it is a continuous cold, unchanging from month to month. The range of temperature in the cooler month is now tremendous. One day starts in early with temperature below zero and by afternoon it has reached 52°, to fall below zero again by next morning. Truly the night is the winter of the tropics. Where these lines are being written, in Michigan, the temperature is falling below zero every night, but it has not been up to 50° in months, an excursion that the thermometer at Vincocaya makes in a few

hours. Its range is 26° in November, in July 43°.[6] There was .54 inch of rain in November, none in July. The average variation of the daily mean from the mean of the month was 1.3° in November, in July 3.7°—the greatest variability we have yet observed, as the diagram suggests. November had one day differing by 5° from the mean, and July had ten.

Cuzco

Now we descend from the wind-swept *páramos* of Vincocaya to the ancient Inca city of Cuzco, sunk in its sheltered valley 3,000 feet below.

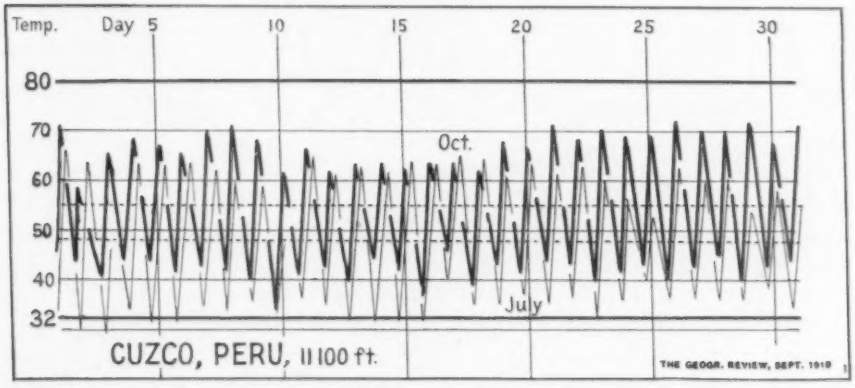

FIG. 9 (year: 1895)

October: mean 55°; range 25°; variability 1.9°; rainfall 4.58 ins.
July: " 48°; " 27°; " 1.0°; " 0.29 ins.

Although half a mile higher in the air than Toluca we are close to Mexican temperatures (Fig. 9).

	Toluca		*Cuzco*	
Mean temperature	April	60°	October	54.5°
	December	49.5°	July	48°
Daily range	April	30°	October	25°
	December	23°	July	27°
Variability	April	2.5°	October	1.9°
	December	1.8°	July	1°

Mild days and cool nights all the year, as in Toluca's cooler month, merely mark Cuzco as cooler than Toluca. Cuzco has 4.6 inches of rain in October with but 0.3 inch in July. The temperatures are still tropically steady. October has a single day varying over 5° from the mean of the month. July has no day that varies more than 3°.

Santa Ana

Now we pass the Andes and examine the temperatures at the ranch Santa Ana among the eastern foothills at the edge of the great Amazonian

[6] For similar examples in other stations of the Peruvian Andes see the graphs of diurnal range of Morococha (14,300 feet) and Santa Lucia (15,500 feet) in Isaiah Bowman: The Andes of Southern Peru, New York, 1916, pp. 172 and 162.

lowland (Fig. 10). Our crooked wire is lifted to the 80° line, for we are now little more than half a mile above sea level. Both November and July have hot days and cool nights. November averages 75.5°, and July 70° with daily ranges of 24° and 29°. The average variation for both

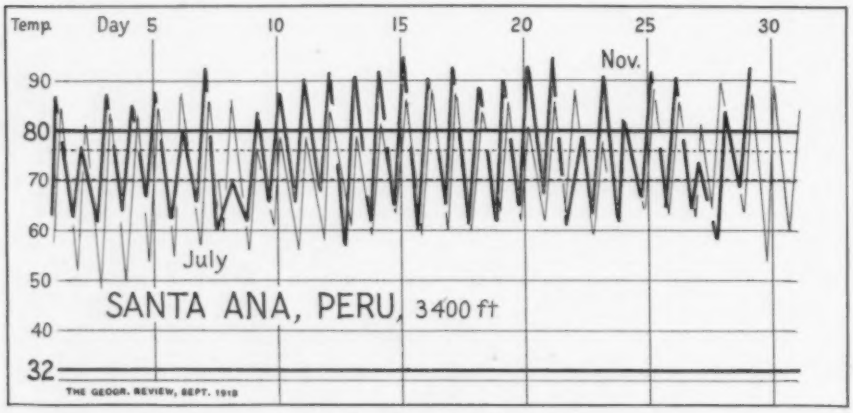

FIG. 10 (year: 1894)

November: mean 76°; range 24°; variability 3.3°; rainfall 1.45 ins.
July: " 70°; " 29°; " 3.3°; " 0.00

months is 3.3°, if the record is trustworthy. November has one day varying over 10° from the mean, and six days over 5°. July has eight days differing more than 5°.

VARIABILITY AS THE DISTINGUISHING FACTOR BETWEEN TROPICAL AND TEMPERATE RÉGIMES

To say the night is the winter of the tropics is to say they have no winter. We have seen the extraordinarily temperate character of the tropical warmth. As far as heat changes are concerned the tropics are the truly temperate regions of the earth. In the tropics the variability of the daily temperature means from the means for their month is very low. The facts are gathered together in the following table.

	LATITUDE	ELEVATION IN 1,000 FT.	VARIABILITY *Hot month*	VARIABILITY *Cold month*
Panama	9° N.	0	1.2°	1.7°
Havana	23° N.	0	0.9°	2.8°
Mollendo	17° S.	0	1.0°	1.0°
Toluca	19° N.	8	2.5°	1.8°
La Joya	17° S.	4	1.4°	3.3°
Arequipa	16° S.	8	0.8°	1.8°
Vincocaya	16° S.	14	1.7°	3.7°
Cuzco	14° S.	11	1.9°	1.0°
Santa Ana	12° S.	3	1.3°	1.3°

Roughly speaking, tropical days may vary about 1½° from the mean of the month in the warm season and in the cool season. The only weather at all like this beyond the tropics is on oceanic islands, where we shall find such equivalent values as 1.3° in the warm weather and 5.6° in the cold, a similarity for the warm season only, cool weather having a variability twice as great. But typical continental places in the temperate zones have variabilities in the warm and cool weather respectively of 3.7° and 6.9°. This is indeed their most striking characteristic as lands with winter, and the winters are particularly characterized by variability. As a certain element of vagueness always attaches to considerations of averages, it may make the matter somewhat clearer to say that out of the nine warm and nine cool months of tropical temperature considered here (a total of 552 days) just 3 days had a mean temperature that differed more than 10° from the mean temperature of their month, and only 47 days differed from the monthly mean by more than 5°. These 47 amount to less than 9 per cent of the total time. But of the 920 days of temperature here studied for the temperate zone 320, or 40 per cent, varied in their mean more than 5° from the mean of the month; 146 days, or 16 per cent, varied more than 10°; and 21 days, or over 2 per cent, more than 20°!

Dwellers in the tropics cannot find winter merely by climbing to mountain snows. They must pass out of the torrid zone into the extratropical regions. The temperature graphs that are encountered can no longer be represented even approximately by one bent wire placed at various temperatures on our diagram, but we need a new wire of very irregular shape, especially to represent the season of winter.

Differences between Warmest and Coldest Months, and Absolute Temperature Range

It is of course also true that the difference is very slight between the warm and cold months in the tropics, as is shown in the little table here printed, the first column of whose figures gives the differences between the mean temperatures of the warm and cool months shown on the torrid

	Differences Between Means of Warmest and Coolest Months	*Absolute Range of Temperatures*
Panama	0.3°	27°
Havana	14°	40°
Mollendo	9°	29°
Toluca	10°	49°
La Joya	8.5°	52°
Arequipa	9°	47°
Vincocaya	16°	75°
Cuzco	7°	45°
Santa Ana	5°	49°
Average	9°	46°

zone diagrams. The mean of the nine values is about 9°. Now the mean difference of temperature of the seasons of the three islands or oceanic stations in the temperate zone discussed in this paper is 22°; for the sixteen continental points in the temperate zone, 38°. Yet more striking are the contrasts between the actual highest and lowest temperatures reached in the torrid and temperate zones. This is given in the second column of figures. The corresponding absolute ranges at temperate zone places attain 120°, 126°, and 129°. The least differences found among the places studied in the temperate zone are 58° and 61°, and the average value is 93°! In other words the difference between mean warm and cold month temperatures is four times as great in the temperate zone as in the tropics, and the absolute range of temperatures twice as great. But for man it is pretty certain that the chief advantage of the temperate zone over the torrid lies in the stimulation resulting from its great daily variability.

Buenos Aires

Buenos Aires, a sea-level station not very far beyond the southern tropic, is a good example to begin with (Fig. 11). It shows new things in

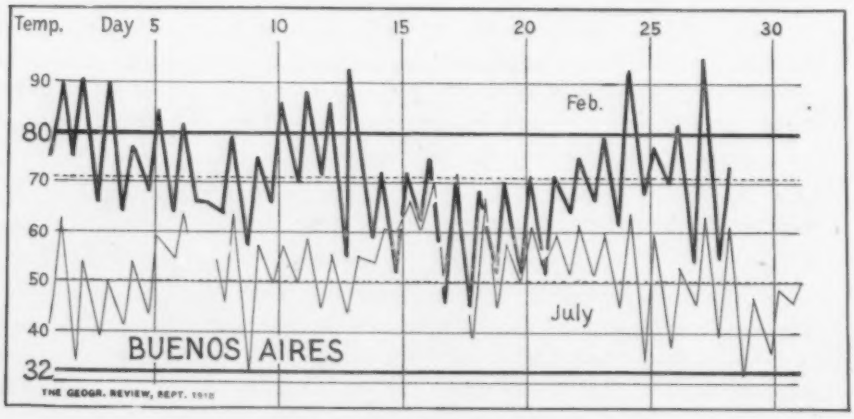

Fig. 11 (year: 1904)

February: mean 71°; range 18°; variability 6.1°; rainfall 2.16 ins.
July: " 50°; " 10°; " 5.0°; " 2.48 ins.

the way of variability of the daily mean. For the summer, February is the type month; for this month the variability is 6.1°, for July, the winter month, it is 5°, that is, twice as much as in the tropics. The eye is satisfied that the graph is of unusual crookedness in comparison with its predecessors. Here are our first "spells of weather," several days that run well below the mean temperature followed by several more running well above it. At Buenos Aires this appears to be most striking in summer, unlike most stations in the United States, where such periods are much stronger

in winter. On one summer day a heat of 95° was reached, as great as any day we had record of at Santa Ana and greater than Havana or Panama during the year of our record. The winter temperature, however, twice touched freezing. February and July each had four days whose mean temperature differed more than 10° from the mean of the month and sixteen that differed more than 5°. But although characteristic in this element of changeableness, the winter of Buenos Aires is not cold. On the 17th the winter day happened to be warmer than the summer one. A winter warm spell may easily be as warm as a summer cool one; but there is no uniformity, no recurring of identical temperature oscillations. The summer is often warm, as often hot. The winter is mild or cool.

Colonia 16 de Octubre

A most interesting record is that of Colonia 16 de Octubre in the southwest Argentine (Fig. 12). It lies in a foothill valley of the Patagonian

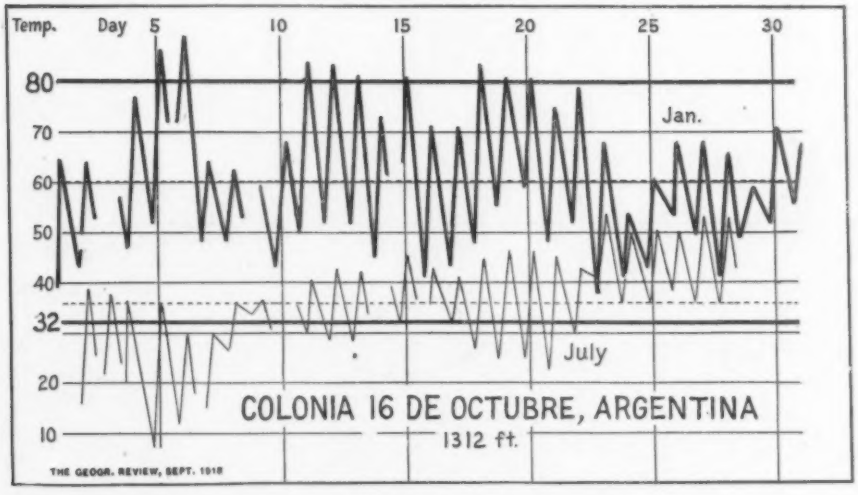

Fig. 12 (year: 1905)

January: mean 60°; range 25°; variability 5.3°; rainfall 0.52 in.
July: " 36°; " 15°; " 4.8°; " 2.70 ins.

Andes, in 43° S., 600 miles farther south than Buenos Aires. It is of course colder than Buenos Aires, 12° colder in the mean of the year. The coldest month is 24° colder than the hot month, against a similar difference of 20° for Buenos Aires. The summer days are warm, occasionally hot, and the nights usually cool. In winter the days are cool, the nights cold. The daily range of temperature is strikingly great, 25° and 15°, while Buenos Aires has but 18° in both months. The smaller range of July is doubtless

due to clouds, as 2.7 inches of rain falls in that month against 0.52 in January. In the means the variability is a little less than at Buenos Aires, in January 5.3° and July 4.8°. Individual days, if allowance is made for missing observations, differ from the mean almost exactly as at Buenos Aires. This is rather surprising inasmuch as Buenos Aires is so much nearer the southern tropic than Colonia 16 de Octubre. Probably the narrowness of the southern continent in these latitudes prevents the development of distinct spells of weather.

New York

From the southern temperate zone we may well turn to the northern. New York is a lowland station like Buenos Aires, but it is six degrees

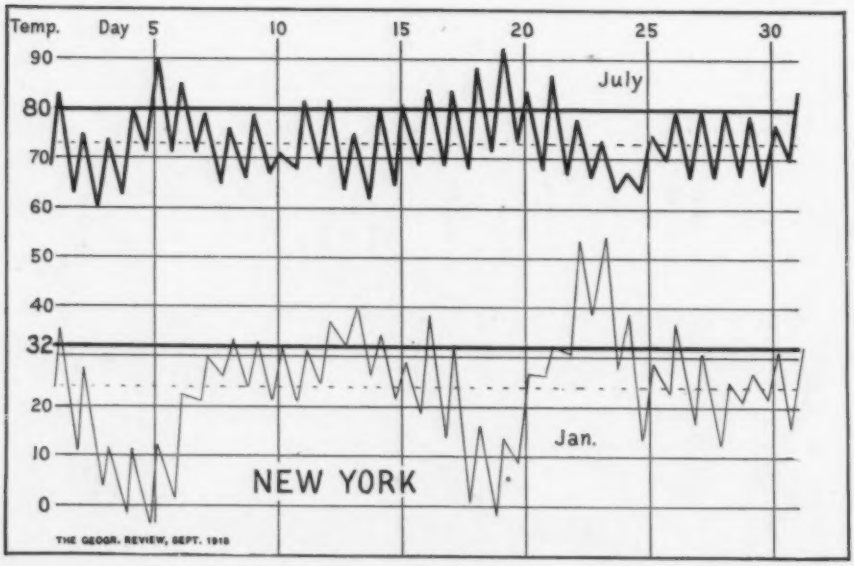

Fig. 13 (year: 1904)

July: mean 73.5°; range 13°; variability 3.0°; rainfall 4.4 ins.
January: " 24.0°; " 12°; " 9.3°; " 3.4 ins.

farther from the equator and North America is three times as wide in this latitude as South America in the latitude of Buenos Aires. The chief novelty shown on the diagram (Fig. 13) is the further separating of summer and winter. At New York summer is frankly warm and winter cold. But the summer is much less variable than the winter. The highest temperature at New York was 93°, the coldest 4° below zero. At Buenos Aires the corresponding figures were 95° and 32°. At New York the mean of the warmest month was almost 50° warmer than the mean of the coldest month, against 21° at Buenos Aires. The chief meaning of this is that

the New York winter is really cold. But at New York the variability is 9.3°, exceeding Buenos Aires in this element almost as much as Buenos Aires outdid the tropical stations. That any day in the month may be 9.3 degrees warmer or colder than the mean of the month signifies very perceptible temperature fluctuations. To go a little into detail, New York in the winter of 1904 had three days of variability greater than 20° and eleven of more than 10°. A glance at the graph shows two very pronounced cold spells of from three to four days duration each, and two principal warm spells of from nine to twelve days.

Dawson City

The most northerly station for which data are at hand is Dawson City in the Yukon, near the Arctic Circle (Fig. 14). The situation is conti-

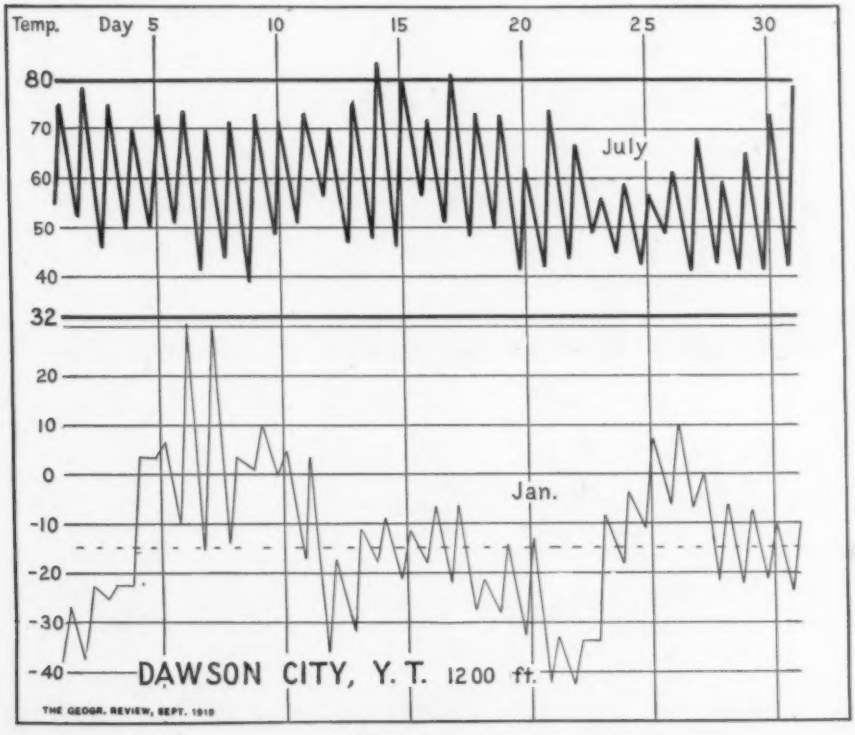

Fig. 14 (year: 1908)

July:	mean	60.0°;	range	24°;	variability	4
January:	"	−14.5°;	"	15°;	"	10

nental, walled off from the Pacific by the lofty Alaskan ranges. Summer days are warm, and nights are mild or cool; but the winter is bitterly cold, night and day. There were only two days in January, 1908, when the thermometer rose as high as 30° in the afternoon to fall back to 15° below at

night. The thermometer stayed below zero all the month except for parts of ten days. The average variability of Dawson days is a little greater than at New York, 4° in July and 10° in January. July had one day the mean of which differed from the mean of the month by 10°. January had five that differed more than 20° from the mean, and thirteen differing more than 10°. The graph illustrates the control of winter temperature changes by spells of weather, even more plainly than at New York. The summer at Dawson City is not strikingly variable. Dawson has the extreme continental type of temperature régime, with 75° difference between the means of the hottest and coldest months, and an absolute range of 126°.

Laurie Island, South Orkneys

Almost as different from land temperatures in the temperate zone as these are from tropical temperatures, are the temperatures of islands in

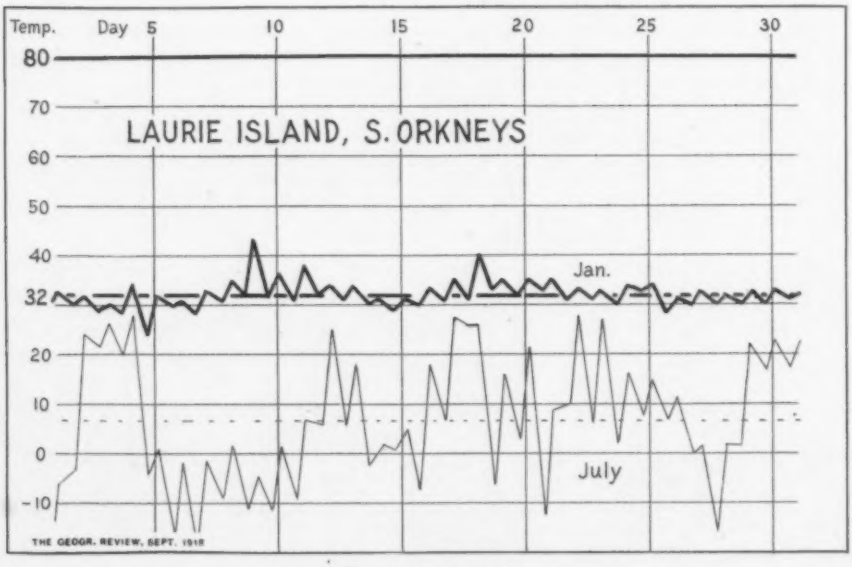

Fig. 15 (year: 1904)

January: mean 32°; range 3.5°; variability 1.5°
July: " 7°; " 13.0°; " 9.5°

the temperate zone. For instance at Laurie Island, 300 miles south of Cape Horn in the South Atlantic Ocean, January, the summer month, is of the oceanic type (Fig. 15). The seagirt land holds as steadily at about 32° as if the sea were a great freezing mixture, thickly studded with floating lumps of ice. But the winter is of very severe character, with notable spells of weather. Always below the freezing point for salt water, it goes lower than —15° four times in the month, as if a frozen sea supplied a continental régime for the winter record. The mean variability of January

days, 1.5°, is to be contrasted with 9.5° for July. Laurie Island is in latitude 61° S., and its winter is the nearest like that of Dawson City that we have yet discussed from the southern hemisphere.

Key West

Another oceanic record is for the island of Key West (Fig. 16), off the tip of Florida in the Gulf of Mexico. Its tropical situation in 25° N.

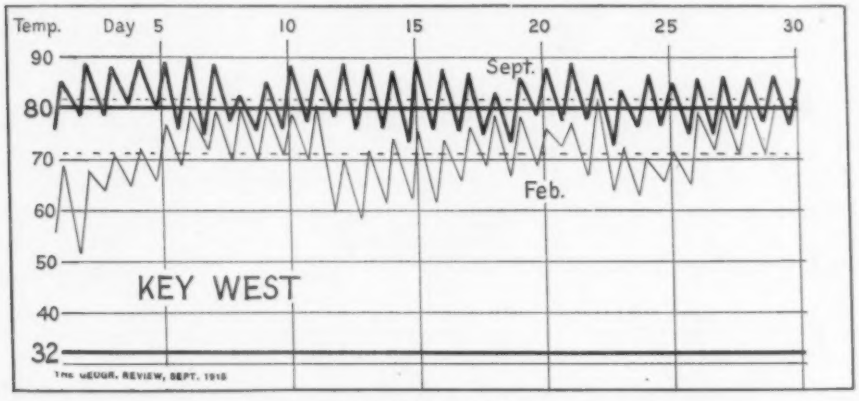

Fig. 16 (year: 1904)

September: mean 82°; range 10°; variability 1.2°; rainfall 3.6 ins.
February: " 71°; " 10°; " 3.7°; " 1.1 ins.

lifts the September temperatures to hot days and nights that are usually warm. September is the warmest month. Its variability is 1.2°. The

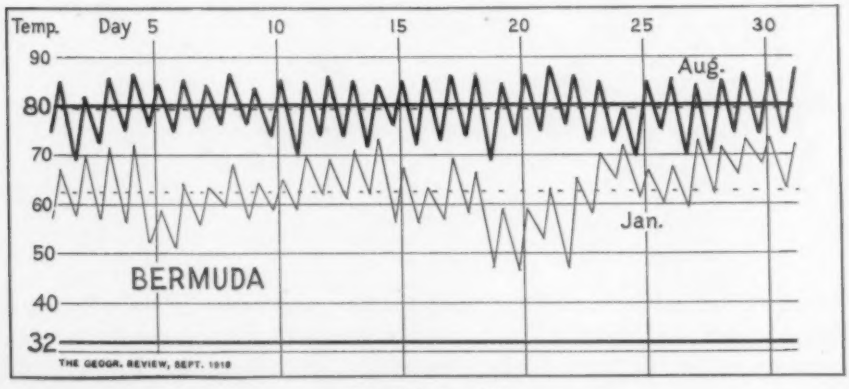

Fig. 17 (year: 1904)

August: mean 79.2°; range 10.0°; variability 1.2°
January: " 62.5°; " 11.5°; " 3.6°

winter, with warm days and mild nights, has fairly distinct spells of weather and a variability of 3.7°. Five days in February differed more

than 5° from the mean of the month. One might be tempted to attribute the winter spells of weather to the adjacent continent of North America were it not that the Bermudas, 800 miles out in the Atlantic, show almost identical forms.

Prospect, Bermuda

The summer of these oceanic islands inclines to the tropical. The Bermudas' hot month (Fig. 17) is almost identical with Havana's except for the greatly lessened daily range of temperature, 10° to Havana's 16°. The winter, too, has a smaller daily range and distinct spells of weather.

St. Johns, Newfoundland

St. Johns, Newfoundland, is thrust far out into the North Atlantic in latitude 48° N. July and February represent the hottest and coldest months of the year 1908 (Fig. 18). The thermometer went up once to

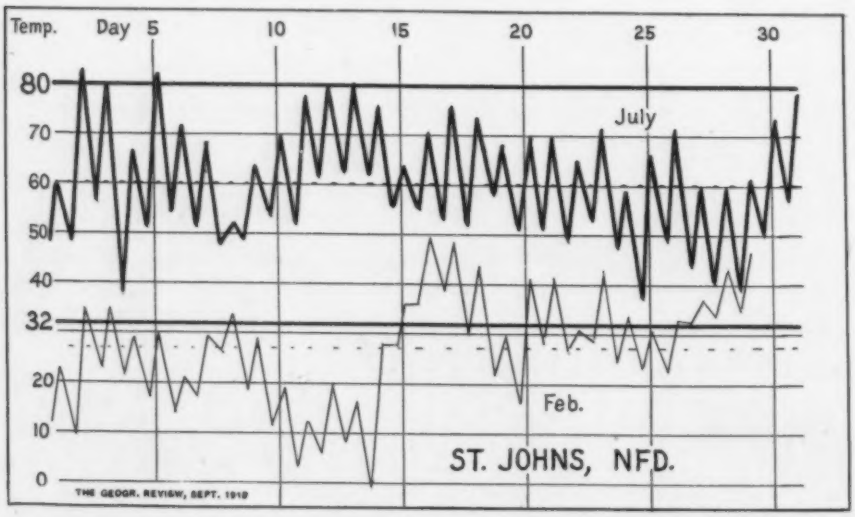

Fig. 18 (year: 1908)

July: mean 60.5°; range 19°; variability 4.8°; rainfall 2.70 ins.
February: " 27.0°; " 12°; " 7.8°; " 5.23 ins.

83° and once fell to −1°. In spite of oceanic surroundings the February temperatures averaged 27°. At mid-month a cold spell carried the temperature below 10° for four days running; then a warm spell sent it up for another three to the high forties. The summer variability of the daily mean averages nearly 5°, the winter one nearly 8°. There is no hot weather, only mild weather and warm for most of the summer, and cold or cool for most of the winter. February had ten days that varied more than 10° from the mean.

Victoria, B. C.

But what type of temperature will obtain at the western border of North America, where the prevailing winds blow from the Pacific? Victoria, B. C., gives the answer (Fig. 19). Apart from the daily range

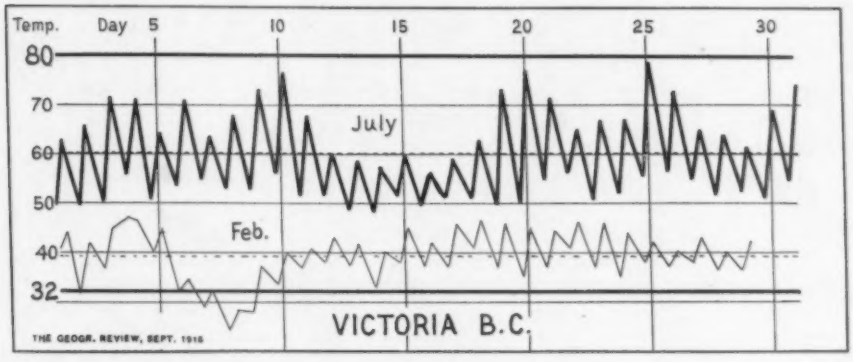

Fig. 19 (year: 1904)

July: mean 60°; range 14°; variability 3.2°; rainfall 0.48 ins.
February: " 39°; " 5°; " 3.8°; " 3.93 ins.

of temperature the summer and winter graphs are not very different in variability, 3.2° in warm weather and 3.8° in cool. The greater range of summer temperature is due to the dryness of that season and its clear skies. Less than half an inch of rain falls in July to nearly four inches in February. The winter is cool; the summer warm by day and mild by night. Most of the winter and part of the summer have the tropical steadiness of diurnal oscillation which were called oceanic for the Bermudas and Key West.

The Pacific coast stations are all bathed in ocean air and have oceanic types of temperature, especially in the greater mildness and steadiness of their winter. But Newfoundland, though far out in the Atlantic, is almost as much bathed in land air as New York because its winds are usually from the west; and so it has a continental temperature. Victoria, on the other hand, had but one day in its winter month that differed as much as 10° from the mean and but seven that differed more than 5°.

Winnipeg

Winnipeg, in about the same latitude as Victoria and St. Johns, is in the heart of the continent. We should expect a strongly developed continental temperature régime there, and we are not disappointed (Fig. 20). The temperature goes up to 93° and down to −36°. Only four afternoons had temperatures above freezing. The winter cold spells are severe, the summer ones perceptible. In summer the days are warm, occasionally hot; the nights mostly mild. The variability has the largest value observed in

this study, 5.6° in July and 11° in January. January had four days with a variation of more than 20° from the mean of the month.

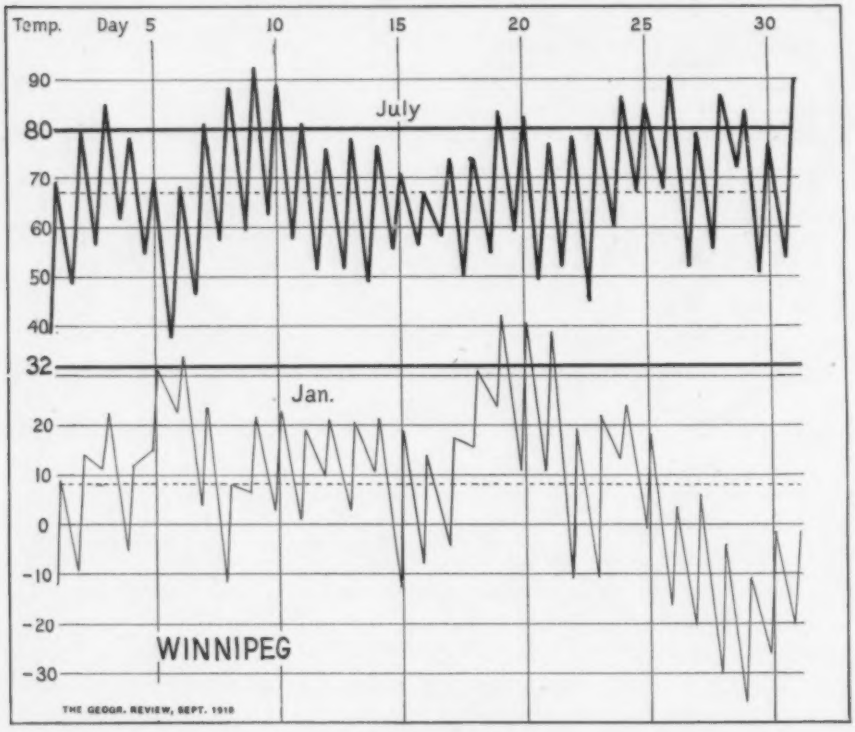

FIG. 20 (year: 1908)

July: mean 67°; range 26°; variability 5.6°; rainfall 1.76 ins.
January: " 8°; " 20°; " 11.2°; " 0.44 in.

TORONTO

February and July at Toronto (Fig. 21) do not differ much from the same months at Winnipeg, except for less severity of winter cold. Summer is warm to hot by day and mild to cool at night. The winter is cold. The variability is 3.5° and 8°, distinctly less than at Winnipeg. The case illustrates the practical working of variability. Winnipeg has a *mean* July temperature 4° cooler than Toronto; but, owing to its high variability, it saw the thermometer go up one day to 93° when at Toronto it was only 92°. Toronto lies five degrees farther south in latitude, and its temperature is doubtless influenced by the nearness to the waters of Lake Ontario.

SAN FRANCISCO

One of the most interesting temperatures studied is that of San Francisco (Fig. 22). The climate is of the mild, Pacific-coast type, milder even

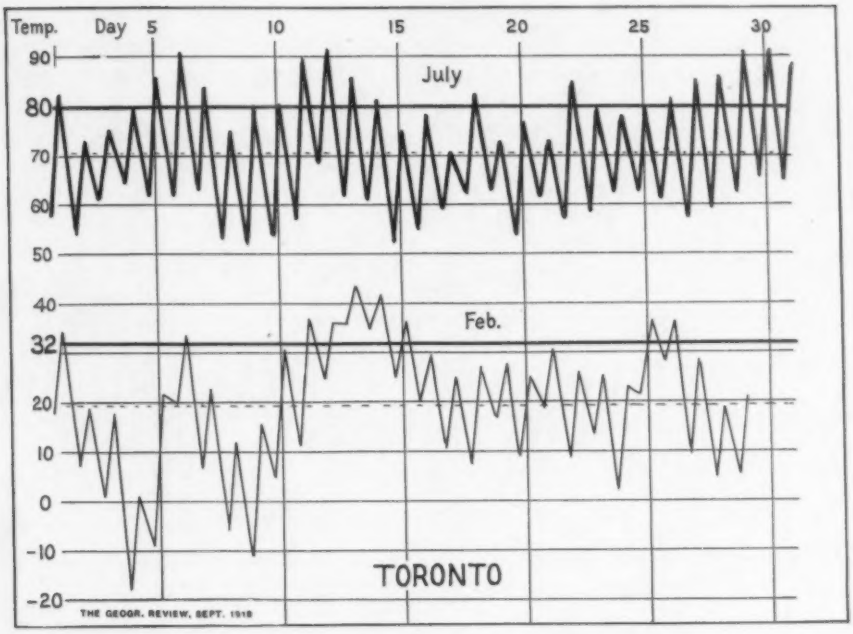

FIG. 21 (year: 1908)

July: mean 71°; range 22°; variability 3.5°; rainfall 2.97 ins.
February: " 19°; " 16°; " 8.0°; " 3.77 ins.

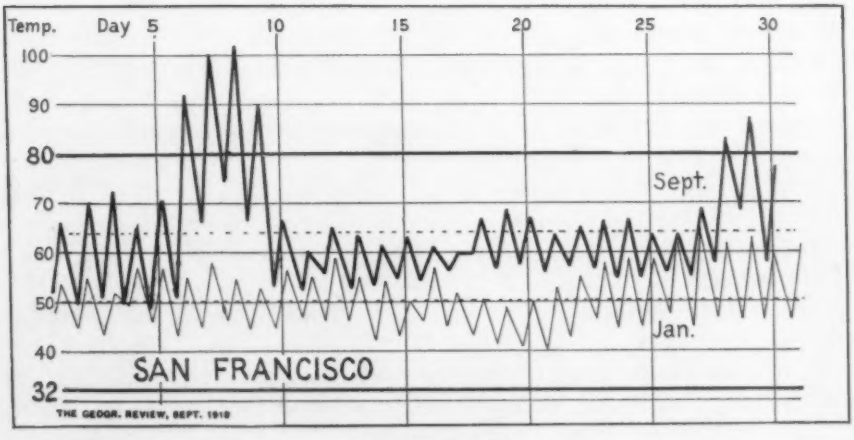

FIG. 22 (year: 1904)

September: mean 64°; range 14°; variability 6.1°
January: " 50°; " 11°; " 2.4°

than Victoria's. September, the hottest month, is barely 10° hotter than January, the coldest month. For the most part the temperature oscillates from day to night almost with the monotony of the tropics, or of islands in the sea, but the warm month has unique freaks of hot weather. Usually the hot spells of the temperate zone are balanced by ensuing cooler or cold ones. Not so the hot spells of September at San Francisco. They rise from the uniform 60° weather to the 80's, 90's, and sometimes 100's for

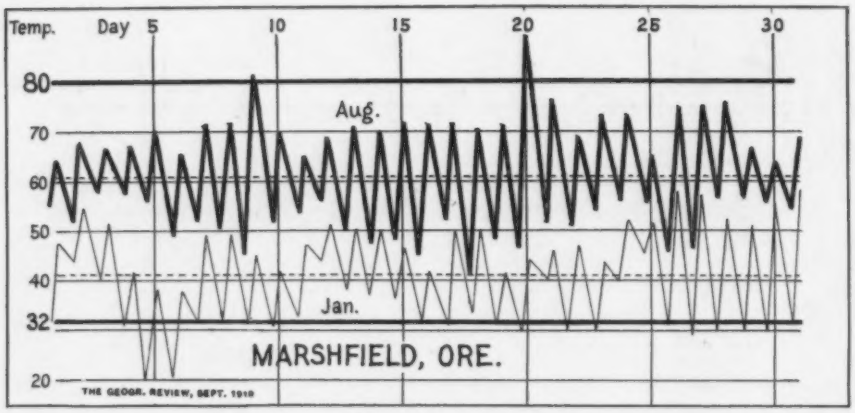

FIG. 23 (year: 1913)

August: mean 61°; range 20°; variability 2.0°; rainfall 0.15 ins.
January: " 41°; " 15°; " 3.8°; " 12.06 ins.

a few days and then drop back again, to oscillate as before between 55° and 60°. There are no counterbalancing cold spells. These hot spells were unusually pronounced in 1904, but the year was not exceptional. The variability of September is of course increased by these hot spells. For a period of eight years it averaged 3.8°. Cold spells do not seem to occur at San Francisco, either in warm weather or cool, and the hot spells described are characteristic of warm weather only. In calling them unique I am comparing them only with other stations that were studied. They do not occur at Marshfield, Ore. (Fig. 23), or San Diego and Los Angeles, Cal. All of these have the even temperature of the oceanic climate, without these singular bursts of heat. They are not mentioned in McAdie's "Climatology of California."[7] To the east of the Coast Range, at Red Bluff, at Sacramento, and at Fresno, in the Great Valley of California the temperatures show the continental heat of summer and cold of winter, although the annual range of temperature is not great; but the daily range has become considerable, and spells of both hot and cold weather are evident in both seasons.

[7] Alexander McAdie: Climatology of California, *Weather Bur. Bull. L.*, U. S. Dept. of Agriculture, Washington, D. C., 1903.

Phoenix, Ariz.

The temperature régime at Phoenix, Arizona (Fig. 24), is a rather moderate example of temperate zone weather. The variability is 2° and 4.6° in the warm and cold months, respectively. This is distinctly greater

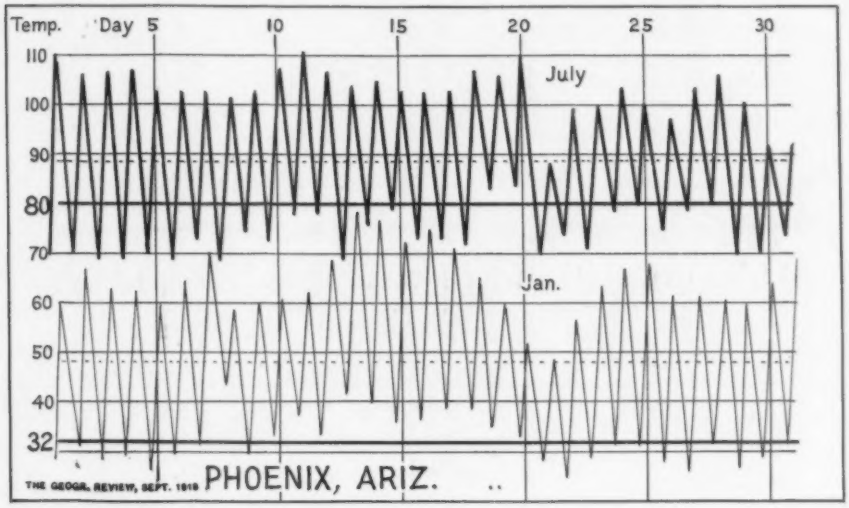

Fig. 24 (year: 1904)

July: mean 88°; range 29°; variability 2.0°; rainfall 0.65 in.
January: " 48°; " 32°; " 4.6°; " 0.26 in.

than in the tropics but small for the temperate zone. Owing to the aridity of the region its daily range of temperature is very large; but the special feature is great summer heat. It was above 100° on all but six days of July, 1904, and three times reached 110°. The winter was not extremely cold. Fourteen times in January it fell below freezing.

Salt Lake City

At Salt Lake City (Fig. 25) with a variability of 3.8° and 5.4°, the daily range of temperature is large in summer but much less in the rainier winter. The summer is rather hot, and the winter distinctly cold. Salt Lake City forms a transition type between Phoenix and St. Louis and other places in our humid east.

Denver

Denver (Fig. 26) has much greater variability, 4.4° and 7.3°, but its summers and winters are in other respects about what we should get if we cooled the Phoenix weather about 20°. It is six degrees farther north in latitude and less arid. It has a hot summer and a cold winter.

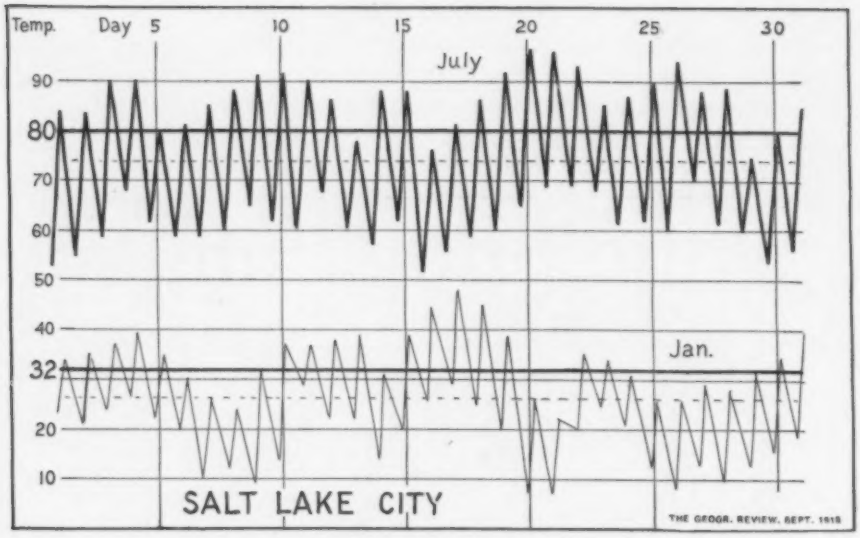

FIG. 25 (year: 1904)

July: mean 74°; range 26°; variability 3.8°; rainfall 0.65 in.
January: " 26°; " 16°; " 5.4°; " 1.45 ins.

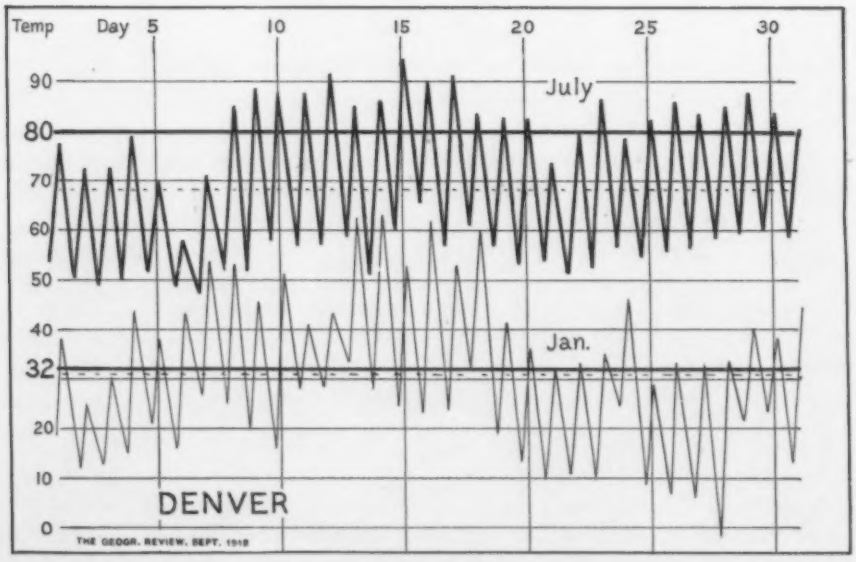

FIG. 26 (year: 1904)

July: mean 68°; range 27°; variability 4.4°; rainfall 1.6 ins.
January: " 31°; " 24°; " 7.3°; " 0.5 in.

St. Louis

In a general way the temperatures of St. Louis (Fig. 27) are about like those of Winnipeg, Toronto, Chicago, Detroit, and Cincinnati, and also

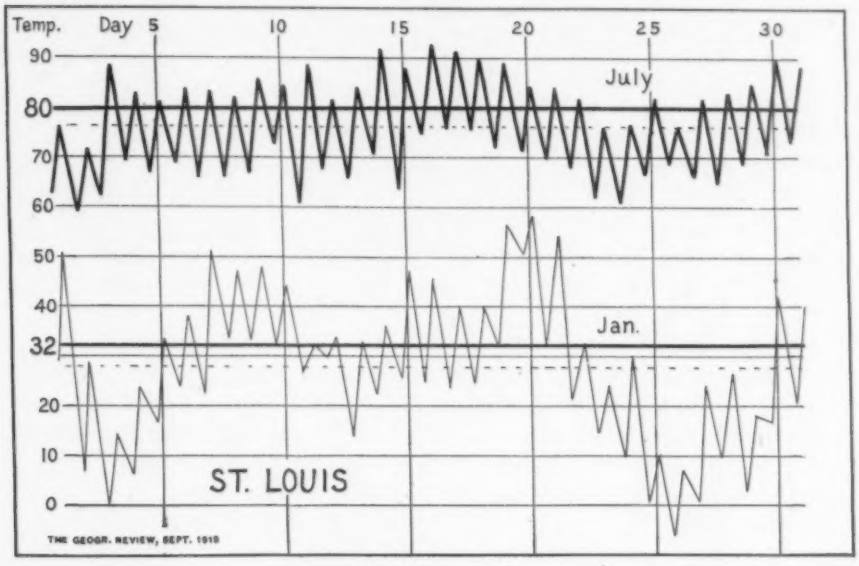

Fig. 27 (year: 1904)

July: mean: 76°; range 16°; variability 3.2°; rainfall 3.1 ins.
January: " 28°; " 16°; " 10.4°; " 3.2 ins.

St. Johns, Boston, and New York. Summer is hot, winter is cold, and variability is very great, especially in the cold season, with a figure of 10.4°.

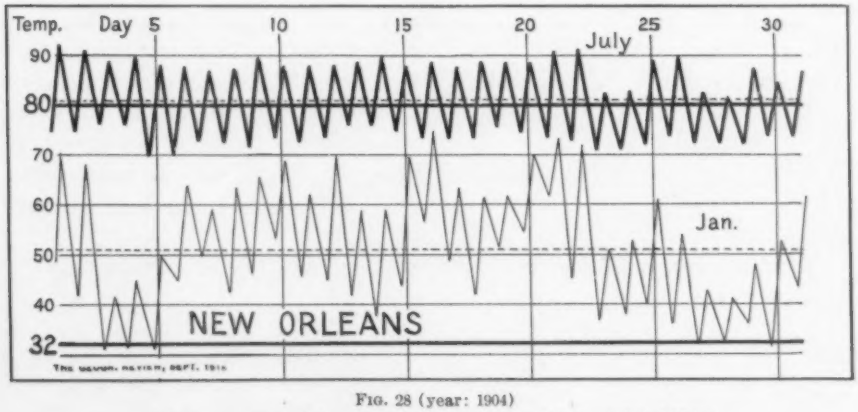

Fig. 28 (year: 1904)

July: mean: 81°; range 14°; variability 1.5°; rainfall 8.30 ins.
January: " 51°; " 17°; " 7.0°; " 1.50 ins.

In 1904 January had five days that differed more than 20° from the mean of the month, fifteen that differed more than 10°, and twelve that differed

more than 5°. For the eastern United States it is the characteristic temperate zone weather, with somewhat variable summer temperatures and a winter of closely following mild and cold spells that are distinctly in contrast.

New Orleans

For the southern part of the eastern United States New Orleans is a rather extreme example (Fig. 28). The summer heats are considerable but of almost tropical steadiness, much like the temperatures at Havana though about a degree cooler. The winter is mild in temperature but strongly variable. Variabilities for New Orleans are 1.5° and 7°. No July day varies more than 4° from the mean of the month, but in January nine days varied by more than 10°.

Factors Influencing Daily Temperature Range

Some mention has been made in the comments on these diagrams of the varying daily range of temperature. It appears to be dependent to a great degree on the amount of clear sky, which in turn is limited by the rainfall, and this implies clouds. Again position near to the sea or remote from it matters a great deal. The places of least daily range of temperature in all America are:

	Daily Range	
	Summer	*Winter*
Laurie Island (in far South Atlantic)	3.5°	13°
Victoria, B. C. (Pacific coast of North America)	14°	5°
Key West (Gulf of Mexico at southwest tip of Florida)	10°	10°
Mollendo (Pacific coast of Peru)	11°	10°
Prospect, Bermuda (island in North Atlantic)	10°	11°

About ten degrees' difference between day and night characterizes these places. Ocean waters lend themselves to a uniform temperature, as they are slow to heat up and to cool off. Moreover the oceanic situation favors clouds and rain, as it is mainly from the ocean surface that the water is evaporated. Victoria, B. C., has about seven times as much rain in February as in July; so that there are many clouds, and the daily range of temperature in that season is only 5°. Laurie Island may have reversed conditions.

Next in order of daily temperature range come the nine seaports:

	Daily Range			Daily Range	
	Summer	*Winter*		*Summer*	*Winter*
New York	13°	12°	St. Johns, Nfd.	19°	12°
San Francisco	14°	11°	St. Louis	16°	16°
Buenos Aires	18°	10°	Panama	16°	19°
Havana	16°	14°	Marshfield, Ore.	20°	15°
New Orleans	14°	17°			

Perhaps it would have been better to have called them eight seaports and St. Louis. They have been arranged in order of the magnitude of

the daily ranges, and St. Louis happens to fall among them. It appears to be an exception to a rule. The situation of these places by the sea makes them prone to cloudiness, which prevents the heating up by day and the cooling off by night that results in a diminished daily range of temperature.

The remaining thirteen places are all from continental interiors, regions that are arid, which means that clouds are scarce. Clear skies result in strong daily alternations of temperature. Six of the thirteen places are in the tropics and seven in the temperate zone. Great range of temperature has no relation to zone but belongs to continental interiors, just as small range belongs to places situated near the sea.

	Daily Range	
	Summer	*Winter*
Dawson City	24°	15°
Toronto	22°	16°
16 de Octubre	25°	15°
Salt Lake City ..	26°	16°
Winnipeg	26°	20°
La Joya	22°	28°
Cuzco	25°	27°
Toluca	30°	23°
Santa Ana	24°	29°
Denver	27°	27°
Arequipa	23°	36°
Phoenix	29°	31°
Vincocaya	26°	43°

This feature of the magnitude of the daily range crosses the variability of the daily temperature, which is very low in the tropics, on shore, and in the interiors alike in the miscalled temperate zone. The combination of daily ranges and variabilities comes to expression in the graphs that have been used to indicate the facts of actual temperatures throughout the length of America.

THE SLAVS OF NORTHERN HUNGARY*

By B. C. WALLIS

[With three separate maps, Pls. XI-XIII, facing p. 280.]

The Slavs of northern Hungary inhabit the mountainous country on the southern slopes of the northern Carpathian Mountains and reach in both the west and the east as far south as 48° N. latitude. The area may be divided into three main divisions: Slovachia in the west which marches with Moravia in Austria, the home of the Moravians who are akin to the Slovaks; Ruthenia-Slovachia in the centre, which borders Galicia on the north with the Poles in the west of Galicia and the Ruthenians in the east; and Ruthenia in the east which touches eastern Galicia and Bukovina, so that the Ruthenians lie on both sides of the Hungarian boundary. Within the confines of Hungary, Slovachia adjoins German Magyaria which lies south and west of the Danube and north of the Drave; Ruthenian Slovachia marches with Magyaria in Central Hungary, and Ruthenia lies north of Rumanian Hungary.

Population

The total population of these three districts is approximately 4,000,000 and is contained within an area of 28,000 square miles, which is but sparsely inhabited in the more elevated northern fringe. The relation to Hungary as a whole is shown on Table I, p. 157 (accompanying "The Rumanians in Hungary"). The country mainly peopled by the northern Slavs is intermediate in size between the states of West Virginia and South Carolina. The average density of the population in northern Hungary is 147 per square mile, which is roughly three times that of the two American States, and exceeds that of Rumanian Hungary.

Slovachia contains the only three municipalities in the north of Hungary: Pozsony (Pressburg), on the Danube, has a population of 78,000 in an area of nearly 2,000 acres (cf. Passaic, N. J., with 72,000 inhabitants and 2,000 acres); Kassa contains 44,000 inhabitants, and has an acreage of 2,400; and Selmeczbánya, including Bélabánya, has 15,000 people spread over 2,200 acres. There are, however, many smaller townships, especially in the center and west; in fact, these small urban areas are more numerous than elsewhere in Hungary.

* This is the second of a series of four articles. The first, "The Rumanians in Hungary," appeared in the August *Review;* the third and fourth, "The Slavs of Southern Hungary," and "Central Hungary: Magyars and Germans," will appear in sequence. An explanatory note on the maps accompanies the first article.

The People of Northern Hungary

Details regarding the changes in the population of northern Hungary during the decade 1900-10 are given in Table I, which corresponds with Table III, p. 159, in the first article (in which Table II, p. 158, represents the population increase by nationalities in Hungary as a whole).

Table I—Population Changes in Northern Hungary, 1900-1910
(*Population in thousands*)

	Total population		Net increase	Excess of births over deaths	Change	Estimated net emigration	Migration within Austria-Hungary
	1900	1910	(b)-(a)		(c)-(d)		(e)-(f)
	(a)	(b)	(c)	(d)	(e)	(f)	(g)
				Slovachia			
Thousands	2,429	2,566	136	297	−161	−119	−42
Per cent	...	...	5.4	11.8	6.4	4.8	1.6
				Ruthenian Slovachia			
Thousands	828	853	25	112	−87	−113	26
Per cent	...	...	3.0	13.3	10.3	13.4	3.1
				Ruthenia			
Thousands	602	686	84	107	−23	−29	6
Per cent	...	...	13.0	16.6	3.6	4.5	0.9

Slovachia contains 2,500,000 people, whose rate of natural increase exceeds that of Rumanian Hungary, and who lost decennially 5 per cent of the population by emigration at a slightly faster rate than prevailed in Transylvania. In addition to the emigrants a third as many people migrated from Slovachia to other parts of the monarchy. With only one-third of the population of Slovachia, Ruthenian Slovachia lost almost an equal number by emigration, this loss being partly made up by internal migration. The emigration equalled the total natural increase of the population so that if there had been no influx of people the population would have been at a standstill. The rate of natural increase is higher still in Ruthenia; and, since emigration is only equivalent in proportion to that from Slovachia and there was a slight inward migration, Ruthenia shows a large increase in population during the decade. The net increase of the population during the last decade is not a unique phenomenon, for in Table II and Figure 1 it is indicated that the increase in Ruthenia has proceeded at an almost constant rate since 1880, and that the increase in Slovachia has always been intermediate between those for the other two districts. The Magyars form from one-quarter to one-third of the population in each district, and their increase in numbers was more rapid than that of the population on the average and was remarkably uniform, not only from decade to decade but as between the three separate areas.

Compared with the Magyars the distribution of the Jews shows important differences: in Ruthenia they form one-sixth of the population and they increased roughly at the same rate as the Magyars. In Ruthenian Slovachia they number one-tenth of the people and show but a slight tendency

to increase in numbers, while in Slovachia they amount to but one twenty-fifth of the inhabitants and tend to decline in numbers. The Jews must have steadily left Ruthenian Slovachia and Slovachia or else have become "official" Magyars.

The Ruthenians form one-sixth of the people in Ruthenian Slovachia, where they increase quicker than the total population but not quicker than

TABLE II—NATIONALITIES IN NORTHERN HUNGARY, 1880 AND 1910

NATIONALITY	SLOVACHIA			RUTHENIAN SLOVACHIA			RUTHENIA		
	1880	1910	INCREASE PER CENT	1880	1910	INCREASE PER CENT	1880	1910	INCREASE PER CENT
Thousands	2,091	2,566	22	743	853	15	446	686	54
Density per sq. mile	132	162	...	114	132	...	78	120	...
SLOVAKS									
Thousands	1,246	1,402	13	354	326	−8	1	2	...
Per cent	60	55	...	48	38	...	...	...	...
RUTHENIANS									
Thousands	1	1	...	120	149	24	209	287	37
Per cent	...	...	...	16	18	...	47	42	...
MAGYARS									
Thousands	608	912	50	146	249	70	98	178	81
Per cent	29	35	...	20	29	...	22	26	...
GERMANS									
Thousands	121	116	−4	52	36	−32	11	14	27
Per cent	6	5	...	7	4	...	2	2	...
JEWS									
Thousands	109	107	−2	66	70	6	62	111	80
Per cent	5	4	...	9	8	...	14	16	...

the Magyars in the district. They number more than two-fifths of the population in Ruthenia, and their total increase is but half the relative increase which has been made by Magyars and Jews in the same area.

The Slovaks show a relative decline in Slovachia and an absolute decline in Ruthenian Slovachia. They form 55 per cent of the population in the former district and 38 per cent in the latter. The Slovaks must be leaving these districts. The Germans show an absolute decline in the western and central districts, where they number about one-twentieth of the population; the decline in the central district is most marked (Fig. 1).

In Slovachia the Magyars have gained, while the Slovaks, Jews, and Germans have been steady. In Ruthenian Slovachia the Magyars have similarly gained, the Ruthenians have gained at less than half the Magyar speed, the Jews were steady, and the Germans have lost heavily in numbers. In Ruthenia the Magyars and Jews have made gains at approximately equal rates, the Ruthenians have gained at almost half their rate, and the small numbers of Germans are relatively steady.

A comparison of Figure 1 with Figure 1, p. 158, indicates that the whole population of Ruthenia is increasing more rapidly, while the whole populations of the Slovak districts is increasing more slowly, than the average for Hungary proper. The Magyars throughout the north have increased much more quickly than the Magyars on the average in Hungary proper. From a comparison between Figure 1 and Figure 2, p. 161, it is clear that Ruman-

ian Hungary is increasing in population more quickly than the Slovak lands, but more slowly than Ruthenia, and that while the Germans in Rumanian Hungary increased in numbers the Germans seriously declined in numbers in Ruthenian Slovachia and remained almost steady in Slovachia

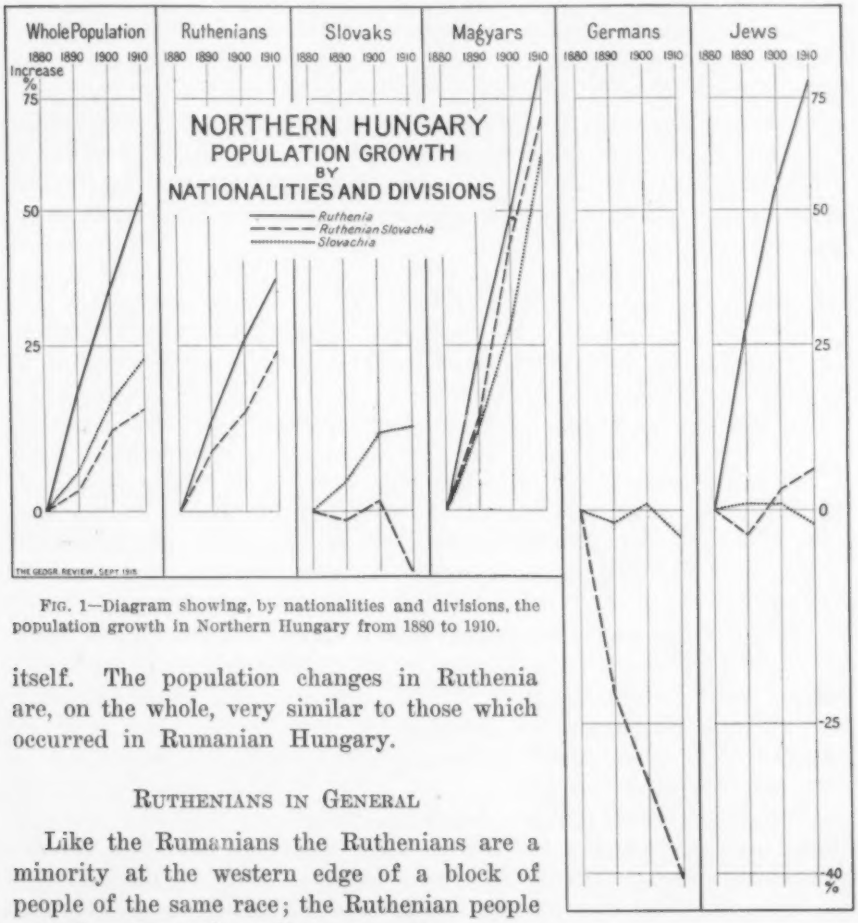

FIG. 1—Diagram showing, by nationalities and divisions, the population growth in Northern Hungary from 1880 to 1910.

itself. The population changes in Ruthenia are, on the whole, very similar to those which occurred in Rumanian Hungary.

RUTHENIANS IN GENERAL

Like the Rumanians the Ruthenians are a minority at the western edge of a block of people of the same race; the Ruthenian people extend eastward from Hungary across eastern Galicia, Bukovina, and into the southwest of Russia—the Ukraine. The 20,000,000 Ruthenians in Russia with 3,500,000 in Austria and 500,000 in Hungary make an estimated total of the Ruthenians in Central Europe of 24,000,000, which is a larger number than the present population of Hungary, approximately double the number of the neighboring Rumanians who live to the south, and about three times the number of the Czech-Moravian-Slovak group to the west. The Hungarian Ruthenians are a westward overflow of this people across the Carpathians, where they hold the high

ground of the Hungarian frontier from just east of the High Tatra to the Rumanian linguistic frontier; the central portion of this area occurs where the Carpathians are lowest and narrowest (Pl. XIII).

The Slovaks in General

The Slovaks of Hungary number about 2,000,000 and form about a quarter of the Czech group of Slavs. Of these Slovaks 1,400,000 live in Slovachia, half the rest in Ruthenian Slovachia, and the remained are scattered in linguistic islands over western and central Hungary. The Czechs are one of the most highly educated peoples in Austria-Hungary and with the Moravians have developed agriculture to the highest pitch it has reached in Austria; the Slovaks of Hungary may be termed the poor brothers of the Czechs.

The Northern Slavs

It is a matter of considerable importance that these two Slav minorities, which meet in the area where the Magyars approach nearest to the Poles (Pl. XIII), form a connecting link with the Czechs of the west and the Little Russians of southern Russia and form a definite political and administrative bond between Austria and Hungary, since both governments have to face the problem of the future development of these Slav peoples. At the same time, it is important that the boundary between Slovak and Ruthenian occurs far to the east of the Moravian Gate, through which is the shortest line of connection between Prussia and the German districts in Austria.

In the west the northern boundary of the northern Slavs coincides with the political frontier of Hungary just where Hungary marches with Polish Galicia. In Plate XIII a portion of the county of Árva is marked as being the home of a people who are mostly Poles. This fact is based upon the census of 1910. There were no Poles officially recorded for that district in 1900, and the population of the county of Árva has decreased since that year; it may therefore be concluded that the people now called Poles were officially called Slovaks in former censuses. Otherwise the Poles remain in Austria and the Slovaks in Hungary; consequently, it may be held that the Carpathians have served as a better linguistic frontier between Poles and Slovaks than the mountains which fringe the Bohemian plateau have served as a linguistic boundary between Germans and Czechs. Yet this northern linguistic frontier of the Czech group of Slavs is better defined by physical features than the southern boundary of the Czech group of Slavs or the western boundary of the Rumanians or any of the boundaries of the Ruthenians. The southern boundary of the Slovaks within Hungary is indefinite; there exists neither a former historical boundary nor a present administrative boundary to which the southern boundary of Slovachia may be referred.

Similarly, while the linguistic boundary of the Ruthenians in Hungary is fairly precise, as there are but few Ruthenian islands, Ruthenia does not coincide with either a former kingdom, duchy, or margravate or a group of existing counties. Just as the linguistic frontier of the Rumanians crosses the left bank tributaries of the Tisza, so the southern linguistic frontier of the northern Slavs crosses the rivers which flow southwards to join the Danube or the Tisza. The Magyars, who are a traditional steppe people, hold the lowlands near these rivers and keep the Slavs in the hills. The boundary zone between the Slovaks and Ruthenians in Ruthenian Slovachia contains an element which is an additional complication, since groups of German villages almost connect the Magyars with the Poles of Galicia and almost separate many islands of Slovaks from the main body in Slovachia.

Natural Increase of the Population

Passing from west to east the excess of births over deaths increases, and Magyars, Slovaks, Ruthenians in ascending order is the invariable rank of the three peoples in regard to natural increase of the population. The birth rate is, as a rule, high and, in the case of the Ruthenians the usual conditions are reversed, since the highest birth rate is accompanied by the

Table III—Vital Statistics, 1900-1910

Nationality	Rates per 10,000 per annum			Infant mortality per cent of living births	Illegitimate births per cent of total births
	Birth	Death	Natural increase		
Slovachia					
Slovaks	389	271	118	20	6
Magyars	353	245	108	20	7
Ruthenian Slovachia					
Slovaks	355	209	146	18	3
Ruthenians	413	249	164	18	3
Magyars	378	248	130	21	9
Ruthenia					
Ruthenians	468	284	184	18	4
Magyars	416	266	150	22	11

lowest rate of infant mortality. The proportion of illegitimate births is highest among the Magyars. Under the head of vital statistics the Ruthenians appear as the hardiest race, the Slovaks come next, and the Magyars last. In comparison with similar conditions in Rumanian Hungary it appears that the Slavs of northern Hungary have more children than the Rumanians, fewer of them are born illegitimate, and approximately equal proportions survive the first year of life. The Ruthenian hill people make a better showing in these respects than the Rumanian hill people. The Magyars of the north do not evidence material differences from the Magyars of the east.

Reconsidering the curves in Figure 1 in the light of the information displayed in Table III it becomes obvious that the curves, in the main,

indicate the results of migratory movements of the population rather than the results of natural increase. It may be recalled from Table I that the proportion of emigrants is high, especially in the case of Ruthenian Slovachia. For example, the curve for Ruthenians in Ruthenia does not slope so steeply as the curve for the total population of Ruthenia, which means that the most vigorous race precisely in the area where its vigor is most manifest failed to increase as quickly as the average of the population of the district. It is requisite, therefore, to consider the migrations of the peoples in some detail.

Emigration

Emigration in Ruthenian Slovachia equalled the excess of births over deaths, in Slovachia it amounted to two-fifths, and in Ruthenia to just over a quarter of the natural increase. In Slovachia the emigration of the Slovaks was excessive and that of the Magyars below their proportion of the

Table IV—Estimated Net Emigration, 1900-1910
(*Figures denote percentage*)

	(A) Nationalities			
	Slovaks	Ruthenians	Magyars	Germans
From:				
Slovachia	70	..	22	5
Ruthenian Slovachia	62	13	20	5
Ruthenia	..	49	39	9

	(B) Destinations		
From:	To: Germany	Rumania	America
Slovachia	2	..	98
Ruthenian Slovachia	..	..	100
Ruthenia	..	4	95

population. In Ruthenian Slovachia the emigration of the Slovaks was even more excessive than further west, while that of the Ruthenians and Magyars was below the average for the district. In Ruthenia the emigration of Ruthenians was slightly above, and that of the Magyars slightly below the average rate. The heaviest losses by emigration, therefore, occur among the Slovaks. It is somewhat difficult to estimate losses by emigration among the Germans on account of the complication introduced by the German Jews; for example, in Ruthenia the Germans number 2 per cent of the population, while the German Jews amount to 10 per cent, and the emigration of Germans (i. e. Germans and German Jews in unknown proportions) was 9 per cent of the total emigration. Practically all the emigrants from northern Hungary go to America. Figure 2 indicates the areas where the emigration of different nationalities exceeded in proportion their relative numbers; the Slovak losses were very generally distributed. With relatively small losses by emigration the Magyars increased in numbers throughout northern Hungary at a notably high rate.

Internal Migrations

In Slovachia there was a loss by movement into other parts of Austria-Hungary which amounted to a third of the loss by emigration. Since the Magyars increased more quickly than their rate of natural increase would appear to justify, it must be concluded that the recorded outflow of citizens represents the net difference between an inflow of Magyars and an outflow of Slovaks. It is known that Slovaks migrate across the border into

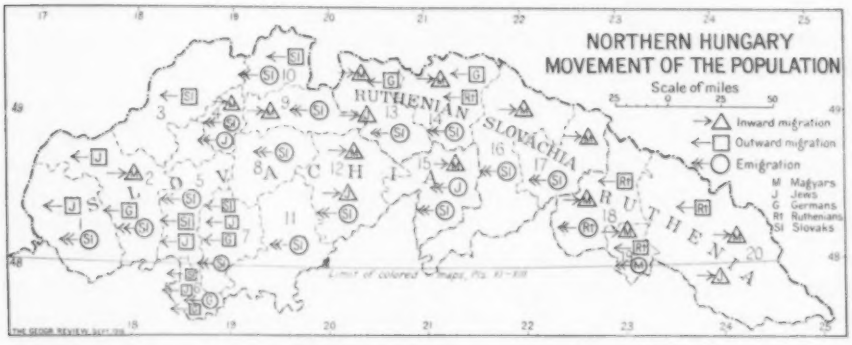

Fig. 2—Cartogram of Northern Hungary showing the movement of the population. Scale, 1:5,400,000. For the names of the counties indicated by hair-line numerals see the key below. The counties are grouped to form three large divisions for the purposes of this article, Slovachia, Ruthenian Slovachia, and Ruthenia. The statistics in the tables and elsewhere in the text relating to these three divisions are based on the constituent counties as here shown.

Key to Counties: 1, Pozsony; 2, Nyitra; 3, Trencsén; 4, Turócz; 5, Bars; 6, Esztergom; 7, Hont; 8, Zólyom; 9, Liptó; 10, Árva; 11, Nógrád; 12, Gömör; 13, Szepes; 14, Sáros; 15, Abauj-Torna; 16, Zemplén; 17, Ung; 18, Bereg; 19, Ugocsa; 20, Máramaros.

Moravia and to Vienna; consequently the Magyar increase in Slovachia represents a gain in nationality figures as a result of an influx of Magyars. It has been suggested that there has been a deliberate falsification of the census returns—that people who are really Slovaks have been recorded as Magyars. In view of the facts here presented such a hypothesis does not appear to be necessary as an explanation of the changes which have occurred. The determinable facts appear to be sufficient to explain in the mass the changes in the proportions of Slovaks and Magyars.

In Ruthenian Slovachia there has been a gain by internal migration equal to the whole net increase of the population. In this area the known facts indicate a tremendous loss by emigration of the Slovaks and a great loss in numbers among the Germans. It is credibly asserted that some Germans and German Jews become Magyars between one census and the next, and such a "Magyarization" may account in part for the great increase of the Magyars; but the detailed figures for the villages show that the Magyar increase occurs very generally for each decade throughout the area. Under such circumstances the suggestion of "falsification" of the census returns does not appear to be necessary; this opinion is supported very

strongly by the steadiness of the Magyar curves for the three decades as shown in Figure 1; and by a comparison between the curves for the Slovak areas and those for Ruthenia.

In Ruthenia there was a slight gain in population by an inflow of outsiders, but the main cause of the increase lies in the exceptional fertility of the inhabitants. The Magyars gained most from the inflow from without.

A conspectus of the migratory movements of the people as they occurred in the several counties is provided in Figure 2. In Slovachia there was an excessive Slovak emigration from eleven counties out of thirteen, and there was in addition loss by internal migration from five of the thirteen counties. There was a notable inflow of Magyars into five counties, and one of Jews into one county. Each of the four counties in Ruthenian Slovachia had an inflow of Magyars and an excessive emigration of Slovaks, and in three of the counties the emigration was about three times the magnitude of the *inward* internal migration; while in two counties the emigration exceeded the natural increase of the population. These facts, as well as the presence of Ruthenians and Slovaks within the same administrative area, form the justification for the classification of these four counties separately from Ruthenia on the east and Slovachia on the west and south. They serve, further, to indicate a definite tendency, well shown in Figure 2, of the Magyars to extend from the Alföld towards the Carpathian boundary, just where the mountains are lowest and the plains extend furthest north.

In Ruthenia there has been both an inflow of Magyars and an outflow of Ruthenians in the case of each of the three counties; the Ruthenian emigration was excessive from one county, and the emigration of Magyars was excessive in the case of another county. Curiously enough this last county is the one with the greatest proportion of lowland. Emigration swamps the inward migration in each of these two counties.

It must be concluded, therefore, that the Magyars tend to move northwards from the center of Hungary into the whole of the area occupied by the northern Slavs, and that this movement has been steadily in progress at least since 1880 and is strongest just where its final success would serve to put a barrier of Magyars between the Ruthenians and the Slovaks. There is no evidence of a compensatory movement of the Slavs in the opposite direction from the hills to the lowlands as has been noted in the case of the Rumanians.

Religions

There are few adherents of the Eastern Church in northern Hungary. Some Magyars and Slovaks are Protestants, but the majority of the people acknowledge the authority of the Pope at Rome, either as Roman Catholics or as Uniates. As in Rumanian Hungary, there are some Magyar Uniates. Ruthenians are usually Uniates; roughly three-quarters of the

Slovaks are Roman Catholics. The differences in the Magyar religions are noteworthy; in Slovachia most are Roman Catholics, in Ruthenia most are Calvinists, and in the central area the two religions are professed almost equally. There is, therefore, a sharp division in Ruthenia on the basis of

TABLE V—RELIGIOUS ADHERENCE
(*Percentage of total for each nationality*)

NATIONALITY	ROMAN CATHOLIC	CALVINIST	LUTHERAN	UNIATE	JEWISH	OTHERS
			Slovachia			
Slovaks	73	..	25	..	2	..
Magyars	69	19	4	..	5	3
			Ruthenian Slovachia			
Slovaks	70	..	7	20	2	1
Ruthenians	2	..	..	95	2	1
Magyars	39	39	..	13	8	1
			Ruthenia			
Ruthenians	..	..	..	94	5	1
Magyars	14	61	..	15	9	1

religion between the two peoples—Ruthenian and Magyar; but among the Slovaks only the Magyar Calvinists are separated by religious beliefs from the Slovaks.

ELEMENTARY EDUCATION

It has already been noted that while Rumanian Hungary enjoys singular treatment as regards education, the Rumanians are very illiterate. Ruthenia enjoys similar treatment; it contains a still larger proportion of children who do not attend school and the Ruthenians are still more

TABLE VI—ELEMENTARY EDUCATION, 1910

	PERCENTAGE OF TOTAL NUMBER OF CHILDREN BETWEEN 6 AND 14 NOT ON THE SCHOOL REGISTERS	PERCENTAGE OF THE UNREGISTERED WHO ARE OFFICIALLY EXCUSED FROM SCHOOL ATTENDANCE	PERCENTAGE OF THE SCHOOLS			
			(i) WHICH ARE:		(ii) WHERE THE LANGUAGE OF INSTRUCTION IS:	
			STATE OR COMMUNAL	CHURCH	MAGYAR	NON-MAGYAR
Slovachia	8	25	18	79	87	13 (a)
Ruthenian Slovachia	5	33	18	81	95	5 (b)
Ruthenia	34	20	34	66	84	16 (c)
Magyaria	12	21	35	62	99	1
Hungary proper	12	29	25	74	78	22 (d)

(a) 13 per cent Slovak. (b) 2 per cent Slovak, 2 per cent German. (c) 8 per cent Rumanian, 8 per cent Ruthenian. (d) 14 per cent Rumanian, 3 per cent German, 3 per cent Slovak.

illiterate than the Rumanians. It must, therefore, be concluded that the Ruthenians, like the Rumanians, are neglected educationally. They form 40 per cent of the population of Ruthenia, yet the language of instruction is Ruthenian in no more than 8 per cent of the schools; Rumanian is the language of instruction in an equal number of schools although the Rumanians are not one quarter so numerous. The proportion of state or communal schools in Ruthenia is well above the average for both Hungary proper and for Rumanian Hungary and is equal to that for Magyaria.

If the Ruthenians and Rumanians are neglected, the Slovaks are oppressed. Although a much smaller proportion of the children escape from attendance at school, the state or communal schools are below the average in number, and the number of schools where Magyar is the language of instruction is out of all relation to the Magyar proportion of the population; the discrepancy is greatest in Ruthenian Slovachia, precisely where the Magyar influx is most marked. Despite this oppression the Slovaks are not so illiterate a people as either the Rumanians or Ruthenians; like their kinsmen, the Czechs, the Slovaks are comparatively the best educated of the "subject races."

Public Health

A disproportion in the medical service as between Magyar and Rumanian has previously been noted; the disproportion between Magyar and Ruthenian is even more marked. Ruthenians rarely receive attention from a

Table VII—Public Health, 1901-1910

	Percentage of deaths		Causes of death (percentage)				Not classified
	Not treated by a physician	Not certified	Tuberculous diseases	Pneumonia or pleurisy	Congenital debility	Senile debility	
Slovachia							
Slovaks	72	64	14	10	15	15	16
Magyars	54	50	16	7	15	17	20
Ruthenian Slovachia							
Slovaks	85	85	13	11	18	20	11
Ruthenians	90	90	21	9	20	17	7
Magyars	42	37	15	9	14	11	24
Ruthenia							
Ruthenians	98	98	12	12	20	14	4
Magyars	53	50	15	9	17	11	17

doctor either before or after death. In the case of the Slovaks, the Slovaks of Ruthenian Slovachia receive less consideration than the Slovaks of Slovachia, while the reverse is the case among the Magyars of these two districts. On the whole, deaths from tuberculosis are more frequent among

Table VIII—Public Health Service, 1910

Division	Number of people per:			Number of females per midwife
	Physician	Pharmacy	Hospital bed	
Slovachia	4,200	9,000	555	920
Ruthenian Slovachia	4,700	9,500	730	970
Ruthenia	7,400	14,000	680	1,030
Magyaria	1,900	7,600	270	540
Hungary proper	3,500	8,600	490	700

the northern Slavs than in Rumanian Hungary. Among the Magyars here, as in Rumanian Hungary, deaths from pneumonia and kindred ailments are not so frequent.

The proportion of deaths not officially classified among the main groups of causes of mortality is low where the medical service is poor, as in Rumanian Hungary, and this fact is a reminder that too much reliance can not be placed upon the official classification of causes of death.

The proportion of doctors, pharmacies, etc., to the population is notably low in Ruthenia, where each doctor, for example, serves four times as many people as a doctor in Magyaria. In each particular regarding the public health service the northern districts fall below the average for Hungary proper.

Economic Conditions

Throughout the whole of the north of Hungary the women are relatively more numerous than the men. This fact is not surprising in the case of the Slovaks, from among whom there is a large emigration; yet it is somewhat unexpected in the case of the Magyars, among whom the disproportion is least. Children below 6 years of age are more numerous, because

Table IX—Economic Conditions
(*Rural Communities*)

Nationality	Number of women per 1,000 men	Age groups (percentage)				Percentage of population over 6 years of age illiterate	Houses (percentage)			People per house
		0-6	6-14	15-60	over 60		Stone or brick	Timber	With thatched roofs	
Slovachia										
Magyars	1,025	16	20	55	9	21	19	8	39	5.4
Slovaks	1,130	17	22	53	8	30	24	60	21	5.6
Ruthenian Slovachia										
Magyars	1,075	16	22	55	7	28	32	3	49	6.0
Slovaks	1,115	18	24	50	8	45	16	64	33	4.9
Ruthenians	1,140	18	26	49	7	70	10	88	45	5.3
Ruthenia										
Magyars	1,046	16	22	55	7	28	4	28	33	6.0
Ruthenians	1,075	20	22	52	6	78	1	98	56	4.8

of the greater fertility already noted; and old people, over 60 years of age, are less numerous proportionately among the northern Slavs than in Transylvania.

The Magyars have the best houses and the Ruthenians the worst; more than five Ruthenian houses out of six are thatched, i.e. are covered with a vegetable covering, which frequently presents an appearance of great untidiness. The proportion of timber houses depends largely upon the locality; where timber is not easily obtained the majority of the houses are built of dried clay; the Slavs live among the forested hills and use timber for the house walls, but they appear to be too poor to use anything but the crudest thatch for the roofs. On the average the Magyar house contains six people, while a Slav house contains only five; both these figures exceed the number of occupants, just over four, for Transylvanian houses.

Railway Transportation

Railway transport in Ruthenia resembles the provision in Transylvania; in the Slovak districts it is similar to that of the Rumanian fore-

Table X—Railways

Division	Mileage	
	Per 100,000 inhabitants	Per 100 square miles
Slovachia	65	10
Ruthenian Slovachia	63	9
Ruthenia	48	6
Magyaria	50	13
Hungary proper	71	10

lands. The service is strategic and political in its purposes and, as in the east, fails to provide facilities for local traffic and communications.

Summary

The north of Hungary is a land of three nationalities with a sprinkling of Germans, Jews, and outcrops of Rumanians near Máramarossziget and of Croats near Pozsony. In the main there is one language in use in the schools and the people are either Western Catholics or Protestants. The Jews are relatively more numerous in Ruthenia than anywhere else in Hungary.

The Ruthenians are a small fragment of an eastern people, and they are not articulate politically. Hill men in a forested region they are conservative and, when modern facilities of transport for timber took away much of their habitual occupation of lumber haulage along the roads, they had considerable difficulty in adjusting life to the new conditions. They are a hardy, illiterate, neglected people, whose small numbers render them of little account politically in Hungary, while their unbroken connection through the Ruthenians of Austria with the Little Russians of the Ukraine gives them considerable importance at the present juncture.

The Slovaks are probably the least important, the least capable economically, and the least articulate politically of the three peoples who make up the Czech-Moravian-Slovak group of Slavs, a group which is limited within Central Europe to the confines of Austria-Hungary. They are pastoralists and growers of root crops with a local reputation as makers of cheese from sheep's milk. While Ruthenians and Rumanians have been politically despised and administratively neglected the Slovaks have been actively oppressed by the Magyar bureaucracy, and the strain of the Magyar "progress" has been felt most severely in Ruthenian Slovachia.

The linguistic boundary between the Magyars and the northern Slavs lies in a zone near the southern edges of the Carpathians and leaves the Slavs in the occupation of numerous valleys without close and easy connection one with the other and, therefore, without the geographical impetus

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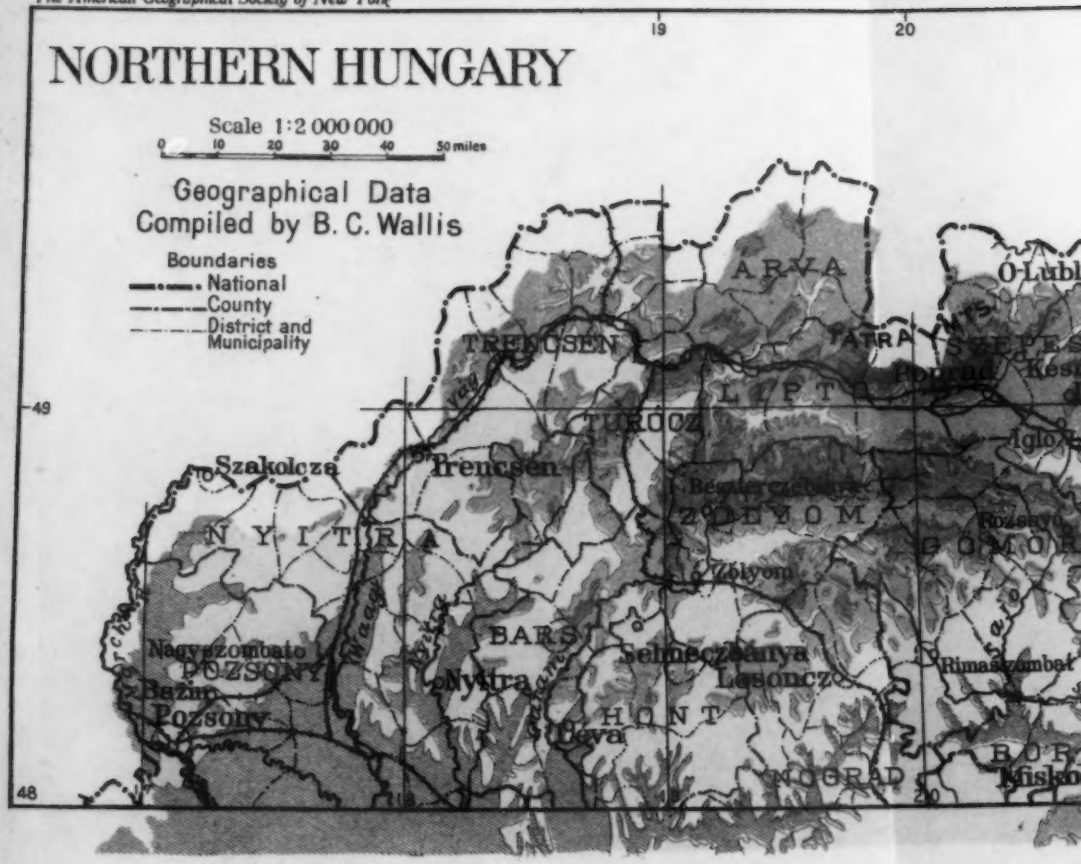

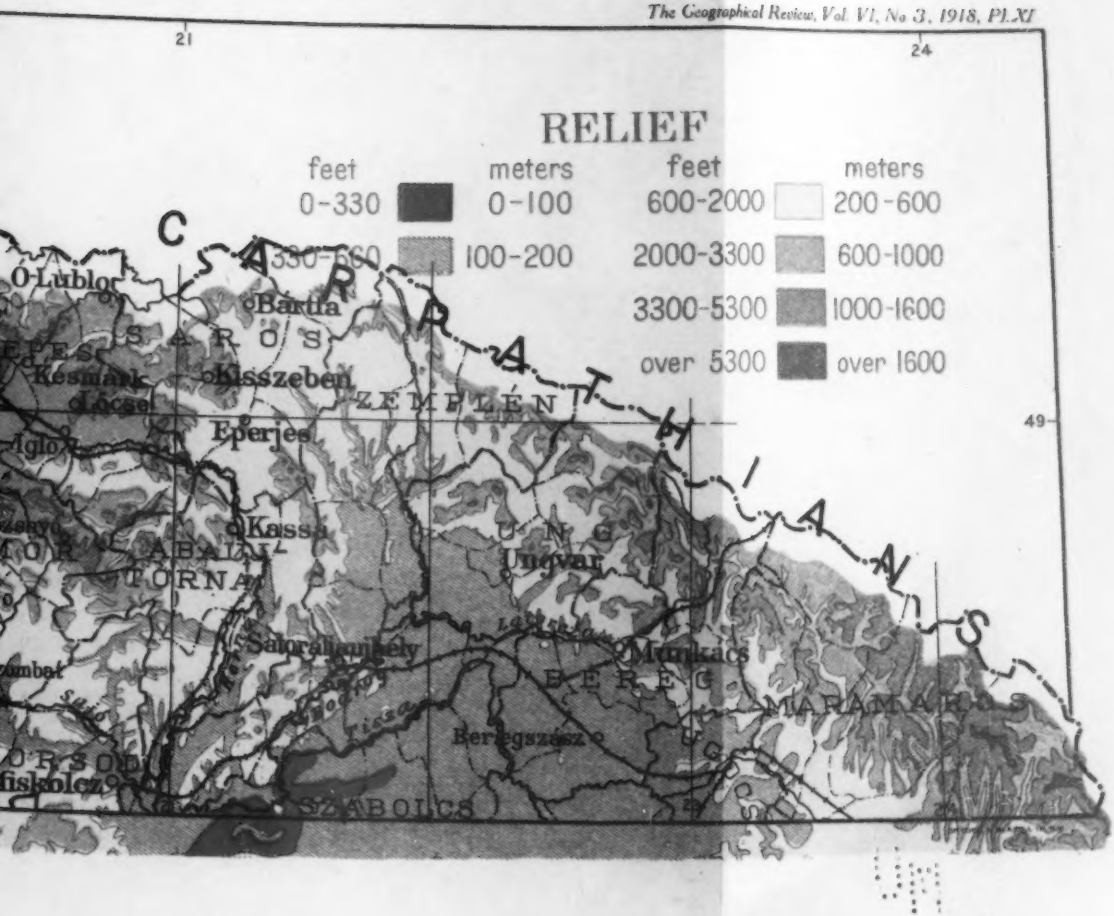
21
24
RELIEF
feet
meters
0-330
0-100
330-660
100-200
600-2000
200-600
2000-3300
600-1000
3300-5300
1000-1600
over 5300
over 1600
CARPATHIANS
Bártfa
Kisszeben
ZEMPLÉN
Eperjes
Kassa
Ungvar
Munkács
BEREG
MARAMAROS
Beregszász
SZABOLCS
49

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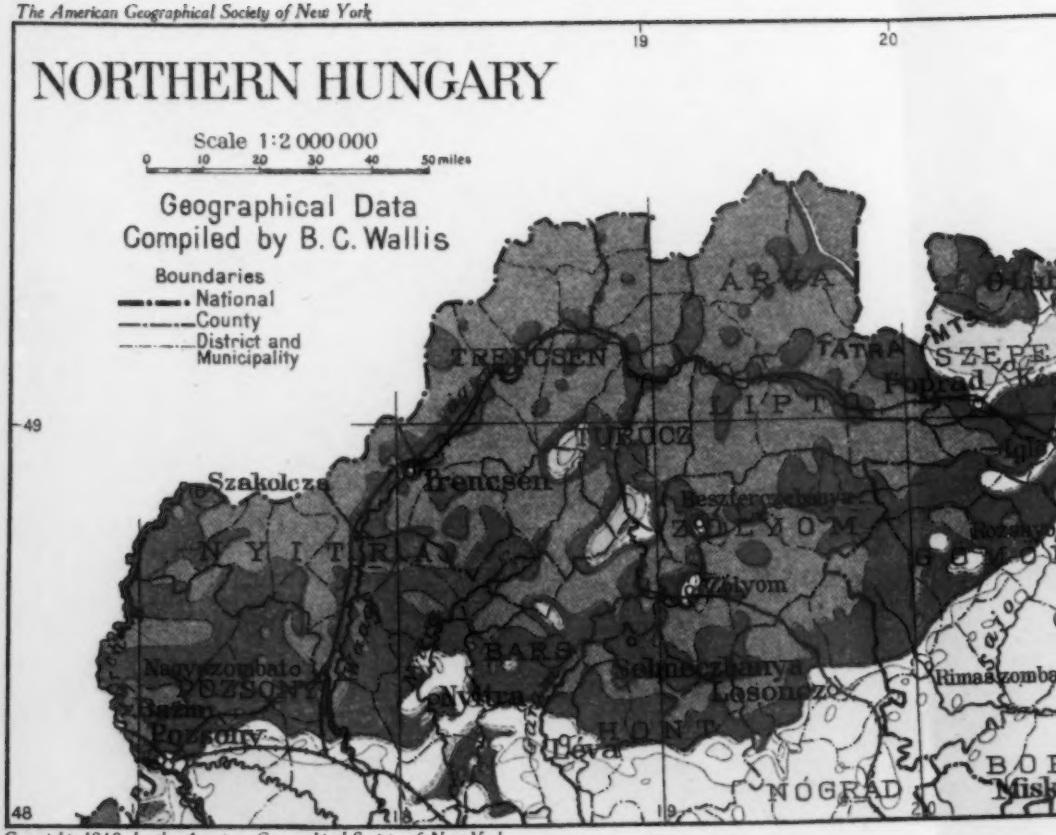

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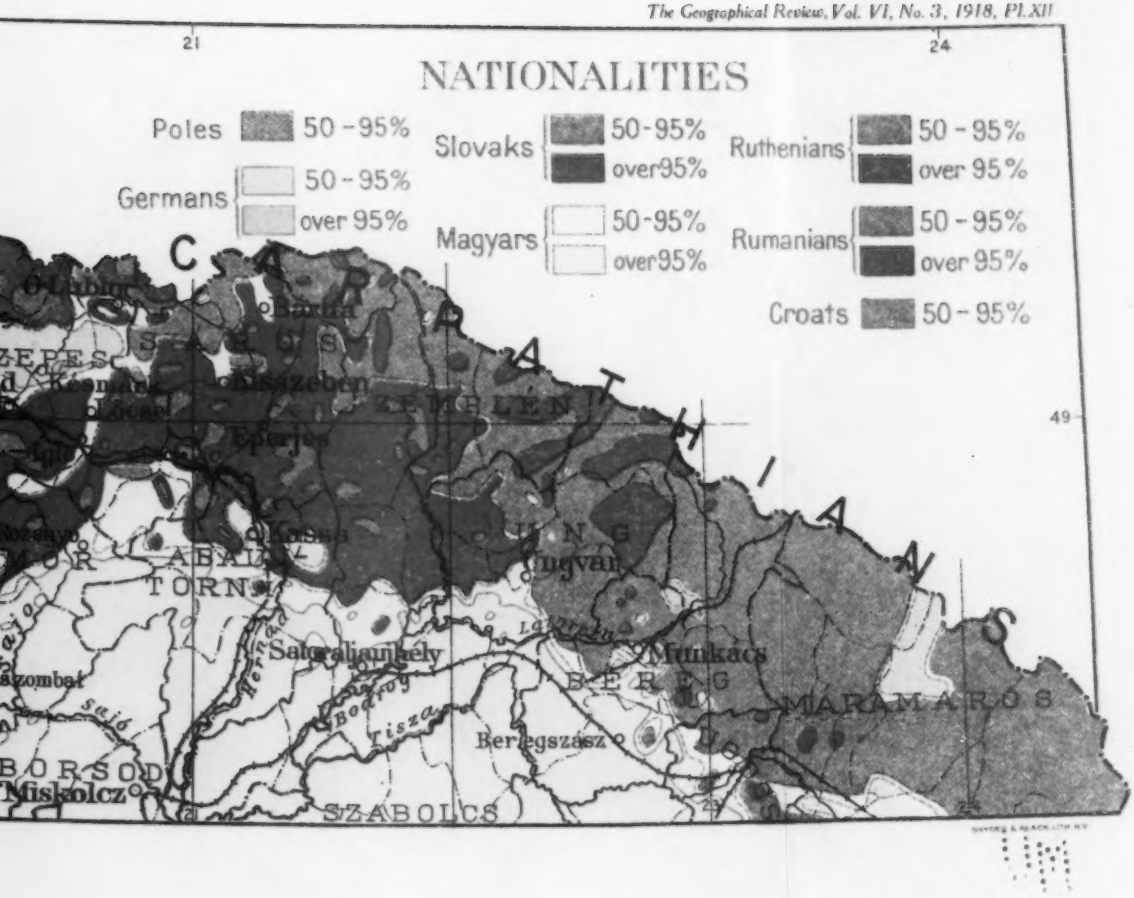
NATIONALITIES
Poles 50 - 95%
Germans 50 - 95%
over 95%
Slovaks 50-95%
over 95%
Magyars 50-95%
over 95%
Ruthenians 50 - 95%
over 95%
Rumanians 50 - 95%
over 95%
Croats 50 - 95%
21
24
49
CARPATHIANS
ZEMPLÉN
Eperjes
Kassa
UNG
ungvar
TORNA
Munkács
BEREG
MARAMAROS
Beregszász
Tisza
Salgóujhely
Losonc
Rima
Sajó
Bodva
Hernad
Sajó
BORSOD
Miskolcz
SZABOLCS

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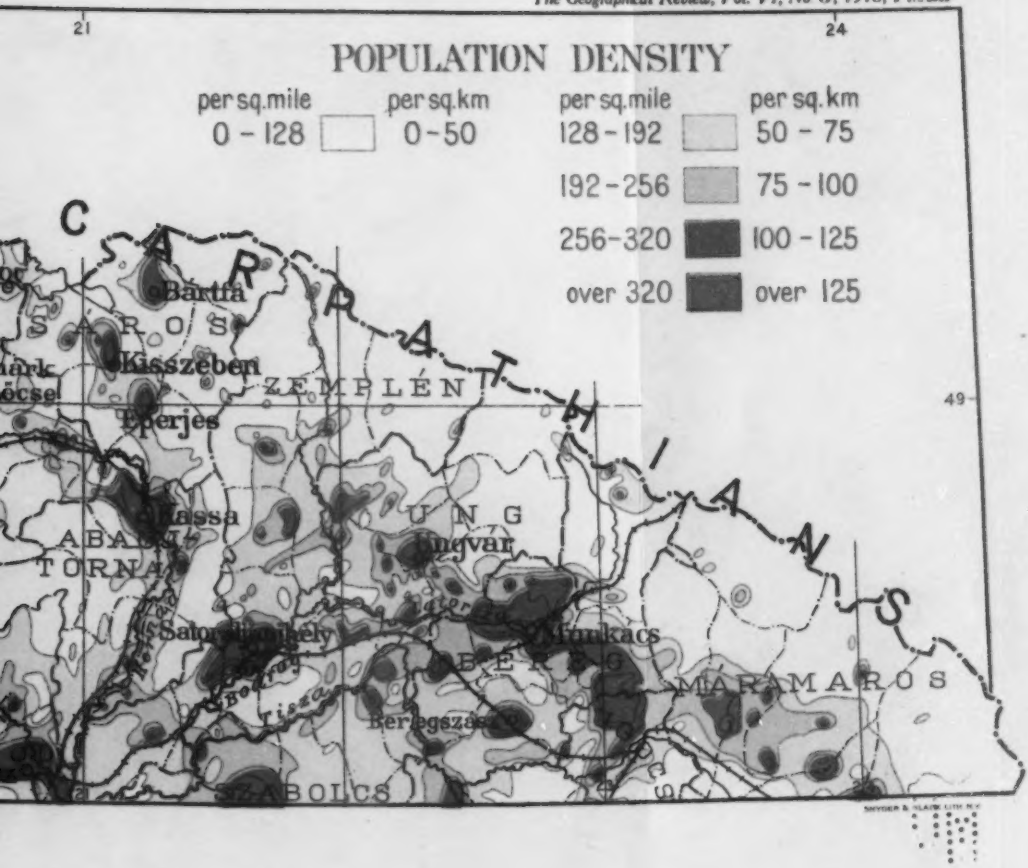
POPULATION DENSITY
per sq.mile
per sq.km
0 - 128
0 - 50
128 - 192
50 - 75
192 - 256
75 - 100
256 - 320
100 - 125
over 320
over 125
21
24
49
CARPATHIANS
Bártfa
SÁROS
Kisszeben
ZEMPLÉN
Eperjes
Kassa
UNG
Ungvar
ABAUJ
TORNA
Munkacs
BEREG
MARAMAROS
Tisza
Beregszasz
SZABOLCS

of easy communications towards racial and national unity. The disintegrating effect of the Magyar possession of the lowland is well illustrated by the insular character of the areas in Ruthenian Slovachia where the Slovaks number more than 95 per cent of the inhabitants (Pl. XIII). The unsettled nature of this region is signified by the fact that between two censuses a comparatively large number of villages change their racial character without changing the proportional division of the people among the churches. A village once Magyar, becomes Slovak, and perhaps changes back to Magyar; other villages change from Slovak to Ruthenian or vice versa; but while the nationality changes the religion remains constant. "Magyarization" of the Slovak lands appears to have taken the form of a steady infusion of Magyars by migration, combined with considerable political oppression by Magyar officials; it has appeared to be much more successful than it has been in reality since it has coincided with Slovak emigration on a large scale.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

News from Stefansson. The Society has received news of the recovery of V. Stefansson from his serious illness and of his plan to return to this country from Fort Yukon some time early in October. It has been arranged to have him lecture at Carnegie Hall immediately after his return under the joint auspices of the American Museum of Natural History and the American Geographical Society. His lecture will be fully illustrated and will be one of the most noteworthy numbers on our program for the year. The preliminary account of his five years' Arctic work included in Stefansson's letter will be published in full in the next number of the *Geographical Review*, together with a map of the region which he has recently explored.

NORTH AMERICA

The Fall of a Meteor in Northern Canada. Unusual descriptions of the fall of a meteor have been received from Vilhjalmur Stefansson in a letter dated Fort Yukon, Alaska, July 8th, 1918. The occurrence took place on or about February 26th, 1918. At the time Stefansson was at Herschel Island ill with pneumonia and he was unable to make notes or secure memoranda. His description is as follows:

"Between 7 P. M. and 9 P. M. the interior of the building in which I was lying was suddenly lighted so brilliantly that shadows were clearly cast in places other than those where the light of the brightly burning lamp could have thrown them. Turning in bed as quickly as weakness permitted, I saw the window (which faced south) brightly lit. There were two persons in the room. One of these, Mr. Leo Wittenberg, ran to the window, and the other, an Indian boy, ran outdoors. Mr. Wittenberg said that from the window he could see pressure ice at sea to the south, a distance of a mile or more, about as clearly as he could have seen it by daylight. This was confirmed by the Indian boy, who, on being questioned, added the information that the disc of the meteor was about the size of the moon; that the light, judged by the visibility of distant objects, was about as bright as daylight, and that the meteor disappeared in the direction of Shingle Point, southeast or a little south of southeast. Every one at Herschel who had a house with a window saw the light, but few if any saw the meteor itself, except our Indian. Others, as well as he, noted that there was a luminous tail for several minutes. No one reported any sound. Mr. Harding, the Hudson's Bay Company factor, and several others at first took the sudden glow outdoors to be the bursting into flame of the mission buildings near by.

"On arriving in the Porcupine valley in April I was greatly interested to learn that what was apparently the same meteor had been seen there by several persons. Those who gave me the most accurate accounts were Constable Claude B. Tidd of Rampart House and Mr. A. H. Anthony of the same place. These two men were on the return journey from a Royal Northwest Mounted Police patrol from Rampart House to Fort Macpherson and were camped in a mountainous country on the Bell-Porcupine portage. There are no accurate surveys even of stream courses in this country; the relation of the Bell to the Porcupine is not even approximately as shown on the maps. Mr. Anthony estimates they were from 95 to 100 miles west (perhaps a little north of west) of Macpherson, 15 miles west of their crossing of the Bell and 40 miles east of the point where the portage trail strikes the Porcupine.

"The date was probably the 25th of February, though it might have been a day later or earlier. Camp had been pitched for the evening, the tent door facing north. The sky was clear and the moon near the full. It was about nine o'clock when the meteor was seen. It became incandescent at a point a little west of true north and about 60 degrees from the horizon. Its course was slightly curved and made an angle of a little under 45 degrees with the horizon. It took about a second to fall and disappeared behind a mountain that loomed high in the northeast. Some part of its course from the point of appearance and another portion near the mountain were not illumined after its passage, but the middle third of the course was defined by a cigar-shaped

'cloud' of illuminated 'smoke' of a puffy appearance resembling thick, white summer clouds or the puff of the white smoke from a big gun. This gradually became less bright but persisted for at least five minutes, and probably considerably longer. After an interval, that Mr. Anthony estimates at four minutes from the disappearance of the meteor, three loud 'rolls of thunder' were heard to the east or northeast. These resembled summer thunder in character but were briefer. They were distinctly not single booms, as those of a big gun.

"On arrival at Fort Yukon I found testimony in agreement as to the date and appearance of the meteor save in the matter of direction. On the evening of February 26th, between 7 and 9 P. M. the mail carrier was on his way from Circle to Fort Yukon about 8 miles upstream from Fort Yukon. He saw the meteor appear in the east considerably less than 45 degrees from the horizon and disappear in the east-southeast right over the tree tops, not over 5 degrees from the horizon. It burst into myriad fragments. The 'tail' it left seemed to be produced by the burning of the sphere 'on the edges,' and it disappeared almost immediately. The latter statement is contrary to the observation of Messrs. Tidd and Anthony, but possibly this was because of the cloudy weather on the Yukon, whereas the others observed the meteor in a clear sky. The mail carrier thought the meteor to have been a little smaller than the moon when full, but the light was equal to daylight and pure white. He heard no noise when the meteor burst. He and his companion, whom I have not seen, seem to have been the only white men who saw it near Fort Yukon, though all saw the light it created. Knowing little of such phenomena, the two men made a compact that they would tell no one of what they had seen as they feared to be ridiculed or called liars. When, however, they learned that the light had been seen in nearly every house at Fort Yukon, they also told their version of the story.

"It will be noted that if a line be drawn roughly southeast from Herschel Island in conformity with the statement of our Indian boy, and northeast from the camp of Messrs. Anthony and Tidd, these lines will meet in the vicinity of the Mackenzie delta. I have consequently taken pains to see Mr. William Johnson, fur buyer, who has been in the Delta since February. He tells me that the meteor was seen to fall to the eastward by persons who were in the Delta about 100 miles north of Macpherson and to the south of other persons who were about 175 miles north-northeast from Macpherson. He did not trouble to get accurate directions, so one can only say that the meteor probably fell just west of, or into, the Eskimo Lakes east of the delta. Further information should enable us to determine with near exactness where it fell, even should it prove that no one actually saw it strike. From the delta Mr. Johnson reports three 'rolls of thunder' and the breaking up of the meteor into innumerable fragments before striking the ground."

Eighteenth Century Explorations in the Middle-West: the Routes of the Verendryes. Five years ago considerable excitement was created by the finding at St. Pierre, South Dakota, of the lead plate deposited in 1743 by the sons of that intrepid explorer, the Sieur de Verendrye. More recently (1917) the pioneer voyages of the famous French-Canadian family in what is now United States territory have been commemorated by the establishment of the Verendrye National monument in the State of North Dakota. The monument takes the form of a reservation of about 250 acres surrounding a height locally known as Crowhigh Butte overlooking the Missouri River at the confluence of the Little Knife River (latitude 48°).

The explorations of the Verendryes, father and sons, were primarily undertaken in search of the great geographical objective of the time—the "Western Sea." In the first half of the 18th century European nations were engaged in a lively contest to reach the west coast of North America. Spain having successfully colonized most of the New World was trying to reach California across the desert of the southwest. England had planted settlements along the Atlantic seaboard and established fur stations about Hudson Bay. Her navigators, led by Robert Crow (1737) and Captain Middleton (1742), were now endeavoring to find a northwest passage to the South Sea. From the west, Russia sent out the great Behring who discovered the Strait into the Arctic (1728), and in his second voyage coasted along Alaska (1741). The Verendryes' work was a part of this international race to the west coast. France already held most of temperate North America. The Mississippi was a well traveled trade route from Gulf to Great Lakes. Louisiana had some 6,000 settlers. It was most desirable that France should establish herself on the western sea. The Verendrye proposals met with approval from officials in Montreal, though the French Government furnished no financial support.

Verendrye began his search in 1731 by proceeding from Lake Superior to the Rainy

River. Thence repeated misfortune impeded his progress, though by 1734 he had erected Fort Marepas on Lake Winnepeg. In 1738 he ascended the Assiniboine, built Fort La Reine, today the site of Portage La Prairie, and being there joined by another party journeyed on via the Turtle mountains to a village of Indians named "Mantannes." Here the course followed becomes obscure. Verendrye says the village was on a river in latitude 48° 12′. At a second village of the same tribe one of Verendrye's sons and a companion saw the "river of the Mantannes," unquestionably the Missouri. The exact location on the river, however, is still a matter of doubt. Most investigators, identifying the Indian tribe with the Mandans, a people later made well known by Lewis and Clark, place the spot about the confluence of the Heart River with the Missouri (latitude 46° 50′). A different solution has recently been propounded by Orin G. Libby ("Some Verendrye Enigmas" and "Additional Verendrye Material," *Miss. Valley Hist. Rev.*, Vol. 3, 1916) who, identifying the Indian tribe with the Hidatsa or Gros Ventres, believes the locality to be further north: his identification is the site of the National Monument.

The exact determination of this point is of importance, for not only does it give the terminus of the first journey of the white man into this section of the country but it establishes the starting point of the still more notable trans-Missourian travels of the Verendrye sons, the course of which is still a matter of debate. The problem of their journey may be briefly stated.

On July 23, 1742, the son of Verendrye usually known as the Chevalier and a brother left the Indian village on the Missouri in pursuance of their quest for the Western Sea. According to the Journal of the Chevalier they proceeded in a general southwesterly direction, meeting and traveling with a succession of friendly Indian tribes. In January they came in sight of mountains across which, according to their Indian informants, lay the road to the sea. In the meantime Verendrye had discovered that it was a "known sea," its shores being inhabited by a white people whom he recognized as Spaniards from the descriptions of the Indians. It seems probable that he was in a region that remotely felt the influence of the Spanish traders of Santa Fé. But the way to the sea was blocked by a warlike tribe at enmity with Verendrye's friendly Indians. The whole party retreated in an east-southeasterly direction. Reaching a river, which he says was the Missouri, Verendrye stayed for a time with the local tribe. There, before his departure to the original starting point, he deposited on March 30, 1743, the lead plate of the recent discovery.

How far west did Verendrye go; what were the mountains whence he turned back from his search? Parkman, who has been generally followed, identified the mountains with the Big Horn Range of the Rockies (Francis Parkman: A Half-Century of Conflict, 1892. See Vol. 2, map facing p. 43). The interest aroused by the discovery of the plate has stimulated new inquiry into the problem. The history of the Verendrye family and their discoveries is discussed at length in the South Dakota Historical Collections, Vol. 7, 1914 (pp. 89-402). Two maps accompany the discussion: that by Charles DeLand shows as alternative a longer route reaching as far west as the Powder River and the foot of the Big Horn Range and a shorter route to the Black Hills. Doane Robinson who furnishes the second map believes the shorter route to be the only possible interpretation whereby times and distances can be reconciled with Verendrye's arrival at the spot on the Missouri (St. Pierre) where the lead plate was found. Orin G. Libby, however, questions that this locality represents the original burial place of the plate. He suggests instead a point on the North Platte River and believes that the expedition reached as far as the Big Horn Mountains or the northern end of the Laramie Hills. If Mr. Libby's interpretation of the starting point as the site of the National Monument be correct, argument for the longer route appears to be strengthened. But the question is still far from being solved with certainty. Further research might be continued with profit particularly, as Mr. Libby suggests, along the line of investigation into Indian tribal records for the region west of the Missouri.

A Dry Thunderstorm in California. A remarkable electric storm occurred in Trinity Co., Cal., on Aug. 1, 1917. The spring and summer had been the driest on record. No rain, or practically none, accompanied these lightning flashes, and 80 forest fires were reported. For almost all of August, one-half of the men in the Forest Service in that vicinity were fighting these fires. One forest warden reported that the lightning struck 150 times in an area approximately five miles square, and another reported that the country "looked like one vast Christmas tree, as various trees blazed into light on being struck" (*Mo. Wea. Rev.*, Vol. 45, 1917, p. 500).

R. DEC. WARD.

EUROPE

A Study in City Geography; Lausanne. Lausanne stands near the center of the northern or more frequented shore of the Lake of Geneva. Its position is coincident with a change in the morphology of the shores. To the east the shore is bold, precipitous; westward where the coast begins to swing to the southwest its contours are softer, glacial deposits cover much of the surface, fluvio-lacustrine terraces mark ancient levels of the lake. Inland the horizontal strata give a characteristic tabular topography. To the east the country is very different: the rocks sharing in the outermost folding of the Alps show the accidented topography of the mountain.

Lausanne may therefore be considered to lie at the foot of the great barrier of the Alps. But it also lies at the exit of one of the great passageways through that barrier, the road of the Rhone and the Simplon and Great Saint Bernard Passes. Northwestward from Lausanne the route continues across the Jura following a great transversal fault to Pontarlier and thence by three roads—through Langres, Dijon or Chagny, a little farther south,—gains the Paris Basin. This is a route of memorable history. It was one of the important arteries of the Roman system. In the days that followed the fall of the Empire Lausanne was preserved as a town of the road. Kings passed through on their way to Italy and prelates on their way from Rome. In 1275 Pope Gregory X and the Emperor Rudolph of Hapsburg met here for the consecration of the new cathedral. The Council of Basel held its last session in Lausanne; there was founded here in 1537 the first Protestant Academy for those of French tongue. While Lausanne attracted a spiritual and intellectual life it also attracted a commerce that enriched its burghers. Routes following the great arc of the Alps along the Swiss plateau passed through Lausanne towards Geneva and the Mediterranean. Lausanne is a town of the cross roads.

The coming of the railway has emphasized the importance of the situation. Today Lausanne is the node of the railway system of western Switzerland. In passenger traffic it ranks third among Swiss towns (preceded by Zurich and Basel); in tonnage of freight it ranks fifth. In 1910 the foreign element of the town numbered 15,800 or nearly one-quarter of the entire population: it is a remarkably cosmopolitan agglomeration.

If it is the situation that brings the stranger to Lausanne it is largely the charms of the site with its beauty and its agreeable climate and its traditions that retain him, for Lausanne is not an industrial town. The Roman settlement, itself on the site of an earlier lake dwelling of the Bronze Age, was built on the delta of the Flon river, a site safe enough in the days of the *pax Romana* but not so during the invasions that followed. Then the town like so many others similarly situated (compare Annecy, south of Geneva, R. Blanchard, Annecy, *Recueil des Trav. de l'Inst. de Géogr. Alpine*, Vol. 4, 1916) was transferred to a place more favorable for defense. Lausanne found such in the *colline de la Cité*, a natural bastion defended on either side by ravines. Opposite on a morainic crest grew up the commercial town. The two became fused and the combined city spread up and down the accidented surface. Herein, in the absence of level space, lies the difficulty of creating an industrial center. To meet the commercial needs of the growing population an artificial flat of 17 acres has been built in the ravine of the Flon. Now the city is turning further afield to a fluvo-glacial plain to the west. The newest growth is on a site morphologically similar to that of the earliest. (Charles Biermann, Situation et site de Lausanne, Études de Géographie Urbaine, *Bull. Soc. Neuchateloise de Géogr.*, Vol. 25, 1916, pp. 122-149. For a geographical description of the hinterland of Lausanne see the article by the same author, Le Jorat, *Bull. Soc. Neuchateloise de Geogr.*, Vol. 20, 1909-1910.)

POLAR REGIONS

Arctic

Exploration in Northern Greenland. By the fine work of the First Thule Expedition in solving the Peary Channel problem the leader, Knud Rasmussen, established a reputation that has aroused keen interest in his second expedition (see "The Non-Existence of Peary Channel," *Geogr. Review*, Vol. 1, 1916, pp. 448-452; also the note in the *Review*, Vol. 2, 1916, pp. 65-66, on Rasmussen's "Report of the First Thule Expedition, 1912," *Meddelelser om Grønland*, Vol. 51, 1915). Rasmussen's safe return to his base in North Star Bay, "the northernmost trading station in the world," has been announced by the American Museum Journal for May. Accompanying the

announcement is Rasmussen's own statement of his original plans for the expedition, which it will be remembered was delayed from 1916 to 1917. Letters from Greenland, with further details illuminating in particular the difficulties under which the expedition labored, have been lately received by W. Elmer Ekblaw, geologist of the Crocker Land Expedition, who furnishes the following note for the *Review*.

Hardships Experienced by Rasmussen's Second Thule Expedition. The expedition, composed of Knud Rasmussen, leader; Dr. Thorild Wulff, Swedish botanist and ethnologist; and Lauge Koch, geologist and cartographer, left its base in North Star Bay in April, 1917, and proceeded successfully as far as St. George's Bay (82° N.). Here game failed them, so that, with the exception of a few hares, and a seal or two, they killed no food at all. Unable to proceed beyond De Long's Fiord, about a degree farther north, they turned homeward at that place. One of the Eskimos, Hendrik Olsen, who distinguished himself in the service of Mylius Erichsen's East Greenland Expedition several years ago, was killed and eaten by wolves while out hunting game, just before the party mounted the ice cap to start back to North Star Bay.

The journey across the ice cap was accomplished in the face of almost incredible difficulties. The party ate the dogs one after another; just after the last dog had been eaten they reached Cape Agassiz, near Humboldt Glacier, on the west coast. They were all weak, exhausted, and starving. Knud Rasmussen and one Eskimo started immediately for Etah to obtain succor for the others, who were to follow along more slowly, living on the game that they hoped to kill, until help reached them.

Unfortunately they could find neither hare nor caribou, and in a few days Dr. Wulff became so weak that he could go no farther. After writing brief messages to his family and dictating to Koch a summary of his observations of the flora of the lands immediately south of the Humboldt Glacier, he bade his companions farewell and resigned himself to his fate. Koch, whose strength was fast waning and who was too weak to encourage Wulff to proceed or to help him in any way, continued slowly with the two Eskimos on the weary way toward Etah.

Dr. Wulff had continued his scientific labors to the last. According to the letters, he accomplished a splendid piece of work, both in botany and zoölogy. He had continued his observations until he could go no farther and died, as a brave man would, in the field of his endeavors.

Koch also accomplished satisfactory work. He mapped the entire coast along which he traveled, including several new fiords that he discovered, and collected Silurian and Cambrian fossils far north. According to a letter from Upernivik, dated January 23, 1918, he had not then fully recovered from the effects of his exhaustion and starvation.

W. Elmer Ekblaw

Echoes of the War in Greenland. The world war is making itself felt even in the Smith Sound region. No supplies have reached the station at North Star Bay, and nearly all the ammunition is exhausted. The Eskimos will soon be forced to resort to the primitive methods of hunting and living that they employed before the white man came with his guns, ammunition, cooking utensils, knives, matches, tea, and cloth. In Danish Greenland, where the natives have become quite dependent on the simple provisions and equipment sold them by the Royal Trading Company, the effect is even more pronounced and prospects even darker, for there the people have quite forgotten the methods of hunting employed by their ancestors and have to rely in large measure upon imported supplies.

Last year the hunt was generally poor in the northern districts, with small kills of seal and white whale, the chief resources of the Greenlanders. The summer of 1917 was an unusually severe and unfavorable season, with much snow, cloudy weather, and cold. The winter began early. As far south as Umanak sledging was possible in mid-November, so that the Eskimos could go out to set their seal nets. Heavy ice came soon afterward and did not break up again. The governor and the doctor at Upernivik, while out on a motor-boat journey, were frozen in far from the village and did not escape to return to their homes until after a month's absence.

W. Elmer Ekblaw

Antarctic

The New Importance of the Whale Fisheries of South Georgia. Among the trophies secured to Britain by the voyages of that great Empire builder, Captain Cook, is South Georgia, now a dependency of the Falklands, 880 miles away to the west-northwest. Until a few years ago the desolate isle, set in the stormy sub-Antarctic seas, remained uninhabited save temporarily by the sealers who frequented these waters

FIG. 1.

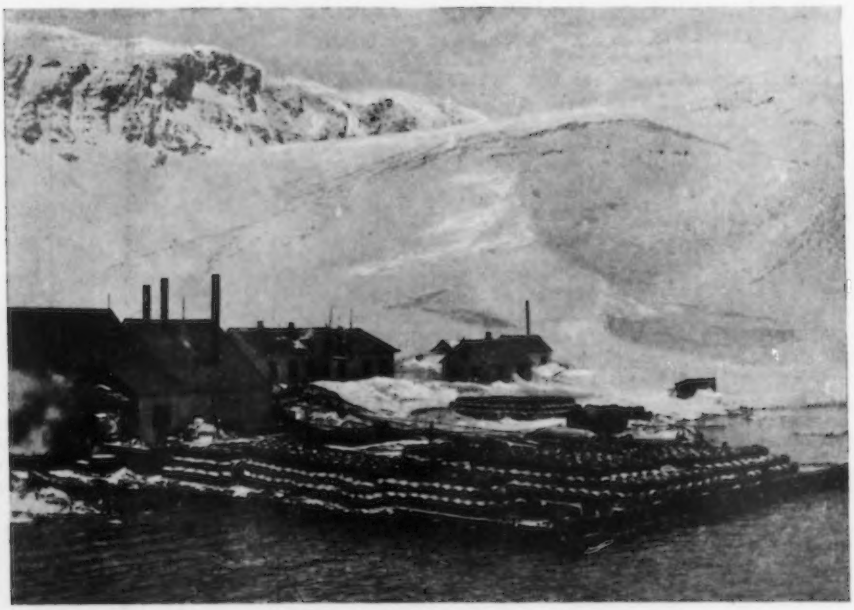

FIG. 2.

FIG. 1—Whale factory, Leith Harbour, South Georgia. (Photo reproduced, by permission, from article by Theodore E. Salvesen, cited on p. 288.)

FIG. 2—Whaling station at King Edward Cove, South Georgia. (Photo reproduced, by permission, from article by J. Quayle Dickson, cited on p. 288.)

as remarkable for their wealth of animal life as for their gales. From Captain Cook's voyage to the recent extermination of the fur seal, sealers have reaped a rich harvest around South Georgia. Today a new harvest is being gathered from these seas, for the island with its sister dependencies is very favorably circumstanced for shore whaling.

In the old days of deep-sea whaling the species hunted were practically limited to the sperm whale, source of spermaceti oil, the bowhead, and the right whale. Before the invention of the steam whaler and the harpoon gun in the sixties of the last century difficulties in the way of capture and reduction rendered impracticable the hunt of other species, although several were capable of yielding "whale" oil. Introduction of shore whaling permitted the whaler to follow these "finner" species among which are the humpback and finner whales so abundant in sub-Antarctic waters (R. C. Andrews: Whale Hunting with Gun and Camera, New York, 1916).

In 1902 the Swedish Antarctic Expedition wintered on South Georgia. The master of the ship *Antarctic*, Captain C. A. Larsen, saw the opportunity for introducing shore whaling. Two years later, with the aid of Argentine capital, he established a whaling company with headquarters on King Edward Cove and an equipment of a factory and two steam whalers. Just before the war the companies operating from South Georgia had been increased to seven (four Norwegian, two British, one Argentine); they had five shore factories and four floating factories. Fourteen other companies operated in the Falklands and its other dependencies, and many floating factories came annually from Europe. During the season 1912-13 the number of whales caught by the South Georgia companies alone numbered 5,000; their yield of oil was 200,000 barrels, nearly half the complete quota from the dependencies and the Falklands as a whole (Theodore E. Salvesen: The Whale Fisheries of the Falkland Islands and Dependencies, in "Report on the Scientific Results of the Voyage of *S. Y. Scotia* During the Years 1902, 1903, and 1904," Vol. 4, Zoölogy, pp. 479-486. See also J. Quayle Dickson: The Empire's Outpost in the South Atlantic, *United Empire*, Vol. 7, N. S., 1916, pp. 161-172). In 1916, of the 634,500 barrels representing the world's production of whale oil, 329,000 barrels came from South Georgia and 216,000 from the South Shetlands.

When whaling began in the southern seas the great majority of the catch belonged to the humpback species. In the catch of 1912-13 this species formed a little over half the total. Actually its numbers appear to vary considerably, for the humpback is a great migrant. Among the species yielding "whale" or "train" oil the humpback is notable because of the high glycerin content of its oil. Here we touch on one of the ramifications of the economic perturbations created by the war. Glycerin is used in the manufacture of explosives; a new value is put upon whale oil; Great Britain by means of its territorial possessions acquires a practical monopoly of the world's output of this product (R. C. Murphy: Island Resources in War and Peace, *Sea Power*, Vol. 4, 1918, No. 6, pp. 383-385; Alfred Bigland: Whales in War, *Land and Water*, No. 2930, Vol. 71, 1918, July 4, pp. 18, 20).

GEOGRAPHICAL NEWS

A New Italian Atlas. The Touring Club of Italy announces a plan for the publication of a large international atlas. It proposes to put the work upon a broad scientific basis and to make Italian scholars independent of German atlases. No large atlas comparable with Stieler or Andree has ever been published in Italy, and political and commercial considerations have been combined in the framing of a broad and scholarly program of map compilation. While the atlas is to be primarily Italian in general character, it will at the same time emphasize international features. Particular attention will be given to the means of communication in different countries and to Italian colonies.

As a first undertaking the Club is forming a library of selected books and articles of a geographical nature and also a collection of maps so as to have at its immediate disposal source material of the highest character. The maps are to be issued to subscribers in sets, and each set will be complete for one or more countries. The whole enterprise will require from eight to ten years for its completion.

The scientific editor of the atlas is Professor Olinto Marinelli of Florence, who will be remembered by American geographers as one of the Italian delegates of the Trans-Continental Excursion of 1912, conducted by the Society. To the Memorial Volume of the Excursion he contributed an interesting paper entitled "Confronto fra i 'bad lands' italiani e quelli americani."

The technical map work is in charge of Signor P. Corbellini, and the general direction has been assumed by Signor L. V. Bertarelli. The high reputation of the gentlemen associated in this enterprise, no less than the fine maps which the Italian Club have published in the past, are a guarantee of the highest success.

The American Journal of Physical Anthropology. In these days of ever more and more numerous scientific journals, it is an unusual experience to greet an addition to the list which seems to be really necessary. But this is the case with the *American Journal of Physical Anthropology*, the first number of which (for January-March, 1918) has just made its appearance.

The name of the founder and editor, Dr. Aleš Hrdlička, is a guarantee that the scientific standing of this new journal will be of the very highest. This quality, added to an obvious desire to give the publication as wide a scope as possible, constitutes its chief attraction. Especially valuable will be the pages devoted to "War Anthropology." They will be the means of helping anthropology to "come down to the ground." For years the older anthropological journals in this country, as well as in England, France, and other countries, have been overburdened with technical discussions whose appeal must perforce be limited. Such papers, however, are essential, and the best of that sort will, from time to time, appear in the new journal; but vastly more important, both as regards immediate value and the generality of their appeal, will be the papers on war anthropology. In giving an irreproachable place of publication to authors who wish to treat of this highly important matter, Dr. Hrdlička has started a movement which may result in putting anthropology back in that place in the public esteem which it held in the days of Darwin and Huxley. It may even result in making some anthropological information an indispensable part of education.

Another excellent feature of the journal is the provision that is to be made for the inclusion of papers in Spanish, as well as in English. This should appeal to our brother scientists in Spanish America, with whom we have many interests in common.

In addition to the points already noted, the journal will be made invaluable by the papers on method, technical questions, anthropometry, and so on. Altogether, it is an admirable publication. PHILIP AINSWORTH MEANS

PERSONAL

MR. T. A. BLAIR of the United States Weather Bureau, Salt Lake City, read a paper on "The North Pacific in Relation to the Weather of Adjacent Lands" at the semicentenary of the University of California, March 18-23.

MR. G. M. BUTLER, since his recent appointment as Director of the Arizona State Bureau of Mines, has undertaken as one of the duties of his new office a collection of data for the preparation of a reconnaissance geological map of Arizona.

MR. D. L. HAZARD, of the U. S. Coast and Geodetic Survey, read a paper on March 30 before the Philosophical Society of Washington on "The Magnetic Survey of the United States." Since 1899, when the work in its present systematic and intensive form was begun, about 5,500 stations have been established, practically completing the proposed number of observation points, and attention is now being directed more especially to the investigations of areas of local disturbance.

SEÑOR SALVADOR MASSIP, professor of geography in the Matanzas Institute, Cuba, and Director of the Cuban Geographical Society, is spending the summer in the United States. He is at present engaged in study at Columbia University. A recent publication by Señor Massip is reviewed in the bibliographical section of the current *Review*.

MR. R. C. MOSSMAN was recently awarded the Keith Prize of the Royal Society of Edinburgh for his work on the meteorology of the Antarctic regions, which originated with the important series of observations made by him during the voyage of the *Scotia* in 1902-4 and has continued to the present time.

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

CANADA

General

MARTIN, CHESTER. **Lord Selkirk's work in Canada.** 240 pp.; maps, bibliogr., index. (Oxford Historical and Literary Studies, Vol. 7. Issued under the direction of C. H. Firth and Walter Raleigh.) Clarendon Press, Oxford, 1916. 8s. 6d. 9 x 6.

Selkirk's life was occupied largely with settling Scottish emigrants in Canada. From 1802 to 1811 efforts were centered upon turning the tide of Scottish emigration from the Carolinas to Canada. Settlements were established in Prince Edward Island and at Baldoon in Upper Canada. The latter colony lasted only a few years; the former's land passed in 1860 from the Selkirk family to the government by sale. In 1807 the idea of colonizing the West began to take shape; and for a decade after 1811 efforts were made to plant a colony at Red River, in what was then the Far West. To this end Lord Selkirk secured from the Hudson's Bay Company a grant of an area of 116,000 square miles "now comprising, in parts of Manitoba, North Dakota, and Minnesota, one of the most fertile districts on the North American continent." Selkirk's name is therefore identified with the West. For half a century the Red River Settlement was an obscure though thrifty frontier colony in the heart of the wilderness. It was destined, however, as the author puts it, to be "the anchor of British rule in the West, the one vested interest which kept intact the territory north of the forty-ninth degree of latitude until the preservation of the West for the British Empire appeared among the avowed policies of the Canadian Confederation." AVARD L. BISHOP

—— **Canada, Water powers of. The Province of Ontario,** by H. G. Acres. 41 pp.; map, ills. **Province of British Columbia,** by G. R. G. Conway. 167 pp.; map, diagrs., ills. **The Province of Quebec,** by F. T. Kaelin. 35 pp.; maps, ills. **The Prairie Provinces: Manitoba, Saskatchewan, Alberta,** by P. H. Mitchell. 78 pp.; maps, diagrs., ills. **The Maritime Provinces: Prince Edward Island, New Brunswick, Nova Scotia,** by K. H. Smith. 34 pp.; map, ills. Dominion Water Power Branch, Dept. of the Interior, Ottawa, 1915.

DAWSON, W. B. **Tide levels and datum planes in eastern Canada, from determinations by the Tidal and Current Survey up to the year 1917.** 95 pp. Dept. of the Naval Service, Ottawa, 1917.

LAUT, A. C. **The Canadian Commonwealth.** (Problems of the Nations, P. L. Haworth, edit.) 343 pp.; index. Bobbs-Merrill Co., Indianapolis, 1915. $1.50. 8 x 5.

LAWLER, JAMES. **Historical review of Canada's timber industry.** *Monthly Bull. of Agric. Intelligence and Plant Diseases,* Vol. 7, 1916, No. 9, pp. 1227-1234. Internatl. Inst. of Agric., Rome.

LEWIN, EVANS. **Canada and the West Indies.** *United Empire,* Vol. 7, N. S., 1916, No. 11, pp. 704-706. [Discusses the desirability of an ultimate commercial and political union between Canada and the British West Indies. Questions in regard to the development of the West Indies and other Crown Colonies and colonies not possessing responsible government are reported under the title "Crown Colony Development" in the succeeding issue of *United Empire* (Vol. 7, N. S., 1916, No. 12, p. 797).]

LEWIS, F. J. **Vegetation distribution in the Rocky Mountains Park.** Ills. *Canadian Alpine Journ.,* Vol. 8, 1917, pp. 87-95.

MORTON, B. R., AND R. G. LEWIS. **Native trees of Canada.** 233 pp.; maps, diagrs., ills., indexes. *Forestry Branch Bull. No. 61.* Dept. of the Interior, Ottawa, 1917. [Approximate distributions are shown.]

RABOT, CHARLES. **Les futures routes d'exportation des céréales du Canada.** Map, ills. *La Nature*, No. 2310, 1918, Jan. 5, pp. 1-6.

SHORTT, ADAM. **The economic effect of war upon Canada.** *Trans. Royal Soc. of Canada*, Vol. 10, 1916, Ser. 3, pp. 65-74.

TRÉMAUDAN, A. H. DE. **The Hudson Bay Road (1498-1915).** xvi and 264 pp.; maps, ills., bibliogr., index. J. M. Dent & Sons, Ltd., London and Toronto, 1915. 7s. 6d. 8 x 5½.

WRONG, G. M., H. H. LANGTON, AND W. S. WALLACE, edits. **Review of historical publications relating to Canada: Publications of the year 1915.** xii and 224 pp.; index. (*Univ. of Toronto Studies*, Vol. 20.) Toronto, 1916. [This interesting and valuable publication ought repeatedly to be brought to the attention of geographical scholars because of its wide range of interest and in general its authoritative reviews, arranged in classified form with a section entitled: Geography, Economics, and Statistics. Both the spirit and style of the reviews are admirable, but occasionally a broader outlook would have assisted the reviewer materially, as for instance on page 11 in the review of Professor Fernald's work and that of W. A. Munn on Vinland. Geographers generally will not agree that "the climate and geographical conditions must have changed so greatly in a thousand years along the Labrador coast that any attempt to identify the places mentioned in the sagas must be today a very hazardous proceeding." Hazardous, no doubt, but not because of *established climatic and geographical changes* in the past thousand years.]

UNITED STATES

General

BOWIE, E. H., AND R. H. WEIGHTMAN. **Types of anticyclones of the United States and their average movements.** 25 pp.; maps, diagrs. *Monthly Weather Rev. Suppl. No. 4.* Washington, D. C., 1917.

In 1914 Messrs. Bowie and Weightman published a monograph entitled "Types of Storms of the United States and Their Average Movements" (*Monthly Weather Rev. Suppl. No. 1*). The present study, of anticyclones, is an extension and completion of the previous paper. The general method followed is the same in the two cases. There is a brief statement of the published views concerning the origin of cyclones and anticyclones, but beyond that this discussion is largely statistical. It, however, contains also brief descriptions of the types of anticyclones, their courses, and the accompanying weather and temperature conditions.

The two regions in which nearly all our anticyclones appear before they enter the United States are (1) off the Pacific coast and (2) Canada west of the 100th meridian, notably Alberta. A few appear first in southern Canada east of the 100th meridian, and some, of another type, seem to form over the Rocky Mountains and the western plateau. Anticyclones pass from the Pacific Ocean to the United States during all months, but the number is at a maximum in spring and fall. The anticyclones from southern Canada west of the 100th meridian are at a maximum in winter. The preponderance of the highs from Alberta over the highs from the Pacific is at a maximum during the winter season.

Our authors classify anticyclones as follows: North Pacific, South Pacific, Alberta, Rocky Mountains and Plateau Region, and Hudson Bay. The respective regions of origin are shown on Chart 1. The prevalence of any one of these types at any time of the year is due to conditions in the general circulation of the winds. Changes in pressure over the Alaskan area, including the Aleutian Islands, are evidently critical controls over the anticyclonic types as well as over cyclonic types and movements. Our authors have based their statistics as to the numbers and movements of anticyclones on the period 1892-1912. The results are presented very fully, in tables, diagrams, and charts. Each type of anticyclone is discussed and described separately and is illustrated by means of charts. Curiously enough, but little detailed work has been done on the tracks of our anticyclones, while our cyclones have received a large share of attention: Messrs. Bowie and Weightman have worked out the approximate average 24-hour movement, for months and in miles, for 5-degree squares, of each type of anticyclone during the period 1892-1912 and have charted their results. This is an important addition to our previous knowledge on this subject.

While many of the details of this discussion will be chiefly useful to official forecasters, there is much information which should find its way, at once, into our courses of instruction in meteorology and, as soon as possible, into our textbooks.

R. DEC. WARD

McCULLOH, WALTER. **Conservation of water: Addresses delivered in the Chester S. Lyman lecture series, 1912, before the senior class of the Sheffield Scientific School, Yale University.** x and 100 pp.; diagrs., ills. Yale University Press, New Haven, 1913.

The geography of the United States especially in its relation to water supply is concisely covered in the introductory chapter of this series of addresses, especial reference being given to the rainfall, evaporation, and public uses of the water with their bearing upon conservation. From this as a foundation Mr. McCulloh has proceeded to develop certain basic data of hydroeconomics, bringing in a discussion of rainfall and run-off as related to topography and geology.

These data lead up to a consideration of water power and of market demands, together with the possibility of supplying needed power by the use of storage reservoirs. There are also taken into consideration certain related questions of water supply for municipal uses, sanitation, and irrigation.

The series concludes with details relating to the water resources of the state of New York and the necessity of utilizing these to a more considerable extent than in the past. Descriptions are given of present developments on the Niagara, Genesee, Hudson, and other streams of the state. The lectures as a whole give an interesting review of conditions and facilitate the study of this important subject. F. H. NEWELL

CLARK, V. S. **History of manufactures in the United States, 1607-1860.** With an introductory note by H. W. Farnam. xii and 675 pp.; maps, diagrs., bibliogr., index. Carnegie Institution, Washington, D. C., 1916. $6.00. 10 x 7. [An exhaustive, systematic, and authoritative treatise.]

DARTON, N. H. **The structure of parts of the central Great Plains.** iv and 26 pp.; map, diagrs., ill. *U. S. Geol. Survey Bull. 691-A.* Washington, D. C., 1918.

ERSKINE, J. Y. **Coal in the United States: Production and trade.** Map, diagrs. *Scottish Geogr. Mag.*, Vol. 33, 1917, No. 11, pp. 481-495.

GABRICI, L. D. **Gli Italiani nell'agricultura degli Stati Uniti.** Map. *Riv. Coloniale*, Vol. 12, 1917, No. 10, pp. 469-479; No. 11, pp. 524-536.

HARTS, W. W. **Natural waterways in the United States.** Diagr., ills., bibliogr. *Ann. Rept. Smithsonian Inst. for 1916*, pp. 545-578. Washington, D. C., 1917.

KEMP, J. F. **The outlook for iron.** Bibliogr. *Ann. Rept. Smithsonian Inst. for 1916*, pp. 289-309. Washington, D. C., 1917.

KULLMER, C. J. **Monthly storm frequency in the United States.** Maps. *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916*, Vol. 2, Section 2: Astronomy, Meteorology, and Seismology, pp. 338-393 (discussion, pp. 392-393). Washington, D. C., 1917.

MANSFIELD, G. R. **The phosphate resources of the United States.** Maps, diagr., ills., bibliogr. *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916*, Vol. 8, Section 7: Mining, Metallurgy, Economic Geology, and Applied Chemistry, pp. 729-766. Washington, D. C., 1917.

MILLER, E. R. **The meteorological influences of lakes.** Maps, diagrs., bibliogr. *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916*, Vol. 2, Section 2: Astronomy, Meteorology, and Seismology, pp. 189-198. Washington, D. C., 1917. ["The relatively important effects of the land and sea breezes and of the monsoons of the Great Lakes of North America."]

MOONEY, JAMES. **The passing of the Indian.** *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916*, Vol. 1, Section 1: Anthropology, pp. 174-179. Washington, D. C., 1917. [United States.]

MOREAU DE SAINT-MÉRY, M. L. E. **Voyage aux États-Unis de l'Amérique, 1793-1798.** Edited with an introduction and notes by S. L. Mims. (Yale Historical Publs.: Manuscripts and Edited Texts, II.) xxxvi and 440 pp.; ills., index. Yale University Press, New Haven, 1913. $2.50. 9½ x 6.

NEWELL, F. H. **Irrigation and drainage.** Ills. *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916*, Vol. 3, Section 3: Conservation of Natural Resources, pp. 260-283. Washington, D. C., 1917. [Relates to the United States only.]

PARKINS, A. E. **A comparison of transportation on the Mississippi Basin rivers and the Great Lakes.** *Journ. of Geogr.*, Vol. 16, 1917-18, No. 6, pp. 201-210.

POGUE, J. E. **Fertilizers: An interpretation of the situation in the United States (The mineral industries of the United States).** 22 pp.; diagrs. *U. S. Natl. Museum Bull. 102, Part 2.* Smithsonian Inst., Washington, D. C., 1917.

QUAIFE, M. M., edit. **The journals of Captain Meriwether Lewis and Sergeant John Ordway, kept on the expedition of western exploration, 1803-1806.** 444 pp.; maps, ills., index. *Publs. State Hist. Soc. of Wisconsin, Collections, Vol. 22.* Madison, 1916. [See footnote 2 to the article "A New Lewis and Clark Map" by Annie H. Abel, *Geogr. Rev.*, Vol. 1, 1916, p. 329.]

SMITH, J. W. **Agricultural meteorology.** Diagrs., bibliogr. *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916,* Vol. 2, Section 2: Astronomy, Meteorology, and Seismology, pp. 75-92 (discussion, pp. 90-92). Washington, D. C., 1917. [United States. For an abstract of another paper of the same title by the same author see the October, 1917, *Review,* Vol. 4, p. 317.]

SMITH, P. S. **United States Geological Survey, Topographic instructions of the.** 228 pp.; diagrs., ills., index. U. S. Geol. Survey, Washington, D. C., 1915. [Replacing the Manual of Topographic Methods, *U. S. Geol. Survey Bull. 307.*]

VAN HISE, C. R. **Some economic aspects of the world war.** *Science,* No. 1201, Vol. 47, 1918, Jan. 4, pp. 1-10; No. 1202, Jan. 11, pp. 27-37.

WARD, R. DEC. **The thunderstorms of the United States as climatic phenomena.** Maps, diagrs., bibliogr. *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916,* Vol. 2, Section 2: Astronomy, Meteorology, and Seismology, pp. 393-411 (discussion, pp. 410-411). Washington, D. C., 1917.

WARD, R. DEC. **The tornadoes of the United States as climatic phenomena.** Maps, diagrs., ills., bibliogr. *Quart. Journ. Royal Meteorol. Soc.,* No. 183, Vol. 43, 1917, pp. 317-329. [Abstracted in the July *Review,* Vol. 6, 1918, p. 71.]

North-Central States.

SHERZER, W. H. **Detroit folio: Wayne, Detroit, Grosse Pointe, Romulus, and Wyandotte quadrangles, Michigan.** 22 pp.; maps, diagrs., ills. *Geologic Atlas of the United States, Folio No. 205.* U. S. Geol. Survey, Washington, D. C., 1917.

The publication by the U. S. Geological Survey of a folio of text and maps covering the area about any large city is a substantial contribution, no less to education than to science and economic development. The Detroit Folio is one of the best illustrations of this form of achievement. The schools of Detroit and of the district round about should make the fullest use of the material now available in well-organized form. The variety of subjects treated makes this folio unusually valuable, and many laymen ought to be interested in it. There is a discussion of the rock strata and their history, of the lake systems that developed in large part in front of the ice of the Pleistocene Epoch, of the soils, forests, and other resources, and of the human occupation of the land. Necessarily the greatest emphasis has been placed upon the surface deposits and their relation to the former lake system. The maps present a clear picture of the origin and growth of the lakes that were the precursors of the Great Lakes of today. No citizen of the Detroit region should fail to be interested in the relation of surface features about his home to the larger aspects of the topography formed in an age long past, remolded by the ice, and still further modified by the vast lakes that once stretched far out from the present depressions. The Detroit Folio answers questions about all these topics. The newspapers of that city would perform a real public service by calling the attention of the public to the geologic and economic material now so readily available. If this folio should have the circulation it deserves there would be required not one but several editions. In that event, and before reprinting, it would be well to revise portions of the first column on p. 4, and of the section entitled "Culture" on p. 5. The size and importance of Detroit may be affected to a marked degree by the commerce between the upper and lower lakes, but that requires demonstration! It is a commerce that chiefly passes by. Even without it Detroit would be a great city. The geography of a modern city is a highly complex subject.

UDDEN, ANTON D. **Cyclonic distribution of weather elements for Davenport, Iowa.** Reprinted from *Trans. Illinois Acad. Sci.,* Vol. 7, 1917? 12 pp.

Professor Udden some years ago published a paper "On the Cyclonic Distribution of Rainfall." The present study is in a sense a continuation of that, and is based on the same method. The subject is one of much importance. The more clearly the *weather* element is brought out, the more vital and the more interesting is the study of

climate. Climate should, as a matter of fact, be studied through weather types and weather controls. It is significant that in the United States, where cyclonic controls are so marked, more emphasis is being laid upon the cyclonic element in climate than elsewhere.

In his study of the cyclonic distribution of the weather elements at Davenport, Iowa, the author has used the morning and evening weather maps for about twenty years. A hypothetical cyclonic area is divided into 25 parts by means of concentric circles and radii. The pressure, wind (direction and velocity), temperature, vapor pressure, relative humidity, cloudiness, and frequency of precipitation are summarized for each section, and the results are then charted. The method is thus the "composite portrait" scheme, long advocated by Professor W. M. Davis, and used by him in his teaching at Harvard fully forty years ago. While Professor Udden's present results are of local rather than general interest, they serve to emphasize the importance of this method of investigation and should serve as a stimulus to students of meteorology elsewhere, who are ready to take up a problem which is in no sense involved and whose solution, for all parts of the country, would undoubtedly improve our weather forecasts.

R. DeC. WARD

BAILEY, E. S. **The sand dunes of Indiana: The story of an American wonderland told by camera and pen.** 165 pp.; ills. A. C. McClurg & Co., Chicago, 1917. 9 x 6. [A pleasant little book that should draw many visitors to the picturesque region it describes. The author makes excellent use of some of the more accessible literature on his subject.]

BRAUN, E. L. **The vegetation of conglomerate rocks of the Cincinnati region.** Diagrs., ills. *Plant World,* Vol. 20, 1917, No. 12, pp. 380-392.

CARMAN, J. E. **The Pleistocene geology of northwestern Iowa.** Maps, diagrs., ills. *Ann. Rept. Iowa Geol. Survey,* Vol. 26, 1915, pp. 235-445. Des Moines.

CONDRA, G. E. **Preliminary report on the potash industry of Nebraska.** 39 pp.; maps, diagrs., ills. *Nebraska Conservation and Soil Survey Bull. 8,* Univ. of Nebraska, Lincoln, 1918. ["The Exploitation of Potash in Nebraska" formed the subject of a note in the *Review,* Vol. 3, 1917, pp. 67-68.]

—— **Detroit as a manufacturing city.** Ills. *Bull. Pan Amer. Union,* Vol. 45, 1917, No. 3, pp. 363-374. [Compare remarks on paper read before Association of American Geographers, *Geogr. Rev.,* Vol. 3, 1917, p. 143.]

DEVEREAUX, W. C. **Forecasts of river stages and floods in the Ohio Valley; their importance to commerce and in conserving life and property.** *Proc. 2nd Pan Amer. Sci. Congr., Dec. 27, 1915, to Jan. 8, 1916,* Vol. 2, Section 2: Astronomy, Meteorology, and Seismology, pp. 825-830. Washington, D. C., 1917.

GREGG, W. R., AND OTHERS. **Free-air data at Drexel Aerological Station, July, August, September, October, November, December, 1916.** 111 pp.; diagrs. *Monthly Weather Rev. Suppl. No. 8 (Aerology No. 4).* Washington, D. C., 1918.

HOLCOMBE, R. I., AND W. H. BINGHAM, edits. **Compendium of history and biography of Polk County, Minnesota.** 487 pp.; ills., indexes. W. H. Bingham & Co., Minneapolis,1916. 12 x 9. [Of this Red River Valley county there is a chapter on the geography and geology by Warren Upham, and various chapters dealing with early American explorations, the fur trade, and the history of settlement.]

HOPKINS, C. G., J. G. MOSIER, AND F. C. BAUER. **Summary of Illinois soil investigations.** Maps, diagrs., ills. *Univ. of Illinois Agric. Exper. Sta. Bull. No. 193,* pp. 451-484. Urbana, 1916.

HUBBARD, G. D. **Geography in the Columbus, Ohio, quadrangle.** Map, ills. *Oberlin College Laboratory Bull. No. 19,* Oberlin, 1917. [Reprinted from *Ohio Journ. of Sci.,* Vol. 17, 1917, No. 5, pp. 137-169.]

LEVERETT, FRANK, AND F. W. SARDESON. **Surface formations and agricultural conditions of northeastern Minnesota.** With a chapter on climatic conditions of Minnesota by U. G. Purssell. vi and 72 pp.; maps, diagrs., ills., index. *Minnesota Geol. Survey Bull. No. 13.* Univ. of Minnesota, Minneapolis, 1917.

MARTIN, LAWRENCE. **The gorge of the upper Mississippi as a rival of the Rhine gorge.** Maps, ills. *Bull. Geogr. Soc. of Philadelphia,* Vol. 14, 1916, No. 4, pp. 127-147.

MOSIER, J. G. **Climate of Illinois.** 125 pp.; maps, diagrs. *Univ. of Illinois Agric. Exper. Sta. Bull. No. 208,* Urbana, 1918. [For convenience of discussion the State is divided latitudinally into five districts.]

ROBINSON, DOANE, AND C. S. STEVENSON. **Third census of the state of South Dakota: taken in the year 1915.** 1,168 pp. Mark D. Scott, Sioux Falls, [1916]. 9 x 6.

SHETRONE, H. C. **The Indian in Ohio.** Maps, ills., bibliogr. *Ohio Archaeol. and Hist. Quart.*, Vol. 27, 1918, No. 3, pp. 274-510.

WILSON, G. L. **Agriculture of the Hidatsa Indians: An Indian interpretation.** viii and 129 pp.; maps, diagrs., ills. *Univ. of Minnesota Studies in the Social Sciences, No. 9.* Minneapolis, 1917. [While a majority of the agricultural Indian tribes of the United States either abandoned their fields before the white settler or adopted his tools and to some extent his methods, the Hidatsas, shut in their stockaded villages on the Missouri, continued their ancient culture with little change until 1885; hence "It seemed probable that a carefully prepared account of Hidatsa agriculture might very nearly describe the agriculture practiced by our northern tribes in pre-Columbian days. It was hoped that this thesis might be such an account."]

ASIA

CHINA

ANDREWS, R. C. **Traveling toward Tibet; The frontier of the forbidden land; Camps in China's tropics.** Ills. *Harper's Mag.*, No. 815, Vol. 136, 1918, pp. 617-632; No. 816, pp. 894-905; No. 817, Vol. 137, 1918, pp. 124-137. [Dealing with the same trip described in the author's articles in the July and August numbers of the *Review.*]

REED, A. C. **Coal mining in China.** Maps, diagrs., ills. *Scientific Monthly*, Vol. 5, 1917, No. 1, pp. 36-49. [A description of the methods employed in the Ping Hsiang (Kiangsi) colliery, the largest coal mine in China: the extremely primitive methods with which these mines have been worked from "unknown ages" and the thoroughly up-to-date methods put into operation by expert German engineers. The author also shows the importance these mines will have when reached by the railroads now projected or under construction from the coast. This coal field is of special value since near it lie valuable deposits of iron, lead, copper, and silver.]

ROBERTSON, J. A. T. **An engineer's travels in western China.** Map, ills. *Far Eastern Rev.*, Vol. 13, 1917, No. 8, pp. 290-294. [Szechuan.]

SCHRAMEIER, W. **Kiautschou: Seine Entwicklung und Bedeutung. Ein Rückblick.** 96 pp.; map, ills. (Schriften des Deutsch-Chinesischen Verbandes E. V.) Karl Curtius, Berlin, 1915. Mk. 1.50. 9 x 6.

VAN BIEMA, EDUARD. **Bladzijden uit mijn dagboek op een reis in China.** *Vragen van den Dag*, Vol. 31, 1916, No. 12, pp. 937-946.

WILTON, E. C. **Yun-nan and the West River of China.** Maps. *Geogr. Journ.*, Vol. 49, 1917, No. 6, pp. 418-440 (discussion, pp. 436-440).

POLAR REGIONS

ARCTIC

NABER, S. P. L'HONORÉ, edit. **Reizen van Willem Barents, Jacob van Heemskerck, Jan Cornelisz. Rijp en Anderen naar het Noorden (1594-1597) verhaald door Gerrit de Veer.** Maps, diagrs., ills., index. Vol. 1, pp. xxvii and 1-178; Vol. 2, pp. cxxxviii and 183-341. (*Publ. Linschoten-Vereeniging*, Nos. 14 and 15.) Martinus Nijhoff, The Hague, 1917. 10 x 7.

The Linschoten Society of the Netherlands has for its object the publication of rare or hitherto unpublished narratives of travel by Dutch mariners and explorers. The fifteen volumes published since its inception in 1909 are indicative of high aims, so that it is no idle prophecy to state that, in due time, the works of this Society will occupy as important a position in geographical libraries as do the Hakluyt publications.

The latest publication of the Society consists of volumes 14 and 15 containing the narrative of Gerrit de Veer, originally published in 1598 in Amsterdam. De Veer occupied a subordinate position with the second and third expeditions sent out to discover the northeastern route to the East Indies. There appears to be every reason to believe that he was a protégé of the intrepid Dutch pilot, Willem Barents, and that he in consequence had a good opportunity to obtain first-hand information regarding the first expedition of which he was not a member, but of which Barents undoubtedly furnished

him ample details. The descriptions of the first and second expeditions are brief, while that of the third is far richer in details.

In 1594 William Barents, a native of Haarlem, was instructed by the States General of the Netherlands to join a squadron which was to attempt the finding of a northeast passage through the Vaigach (Yugor) Straits. At that time, it was of prime importance to find a route by which the Dutch merchants could dispatch their vessels to the East Indies without fear of molestation by Spanish men-of-war. The particular vessels of the squadron which were commanded by Barents had orders to detach themselves from the main fleet and sail to the northward of Nova Zembla. Barents explored the western coast of this island, while the southern expedition, on reaching the Kara Sea and finding open water, returned and, after joining Barents, set sail for The Netherlands, where the commanders spread the joyful tidings that the shorter passage to the Indies had been discovered.

In 1595 a second expedition was dispatched with the purpose of making further observations and of continuing through the Kara Sea. Jacob van Heemskerck, who in later years won renown as Admiral of the Dutch fleet, and Jan Cornelisz. Rijp as well as the chronicler, Gerrit de Veer, held subordinate positions on this expedition. After passing through the Straits of Vaigach, the Kara Sea was found to be one mass of ice and the squadron had to return.

It was now thought that the problem of finding a northeast passage might be solved by adhering to the plans laid out for Barents on the first expedition, *i. e.* by sailing to the northward of Nova Zembla. In consequence, Barents was again sent out, in 1596, with two vessels, one of which was commanded by Van Heemskerck, while Rijp was master of the other. De Veer again sailed with Barents, who was chief pilot of the expedition. It appears that after departing from the home waters, Barents was unwilling to follow the instructions given him by the Dutch authorities and that it was only through the persistence of Rijp that he finally did so. This influence brought to bear on Barents by Rijp resulted in the discovery of Bear Island on June 8, 1596, and of Spitzbergen on June 17, so that the credit of the discovery of these islands should by rights belong to Rijp. On this third expedition, the vessel on which Barents and Van Heemskerck found themselves was caught in the ice, after reaching the eastern coast of Nova Zembla. It was here that the officers and crew of Heemskerck's ship spent the winter of 1596-97, building the renowned wooden house which was discovered in 1871 by a Norwegian whaler and subsequently investigated by Koolemans Beynen with the *Pandora* in 1876. When the mariners found in the spring of 1597 that their vessel was hopelessly damaged, they built two small wooden sloops which ultimately carried the survivors to the Russian settlements on the mainland from whence they finally succeeded in rejoining Rijp, whose ship had withstood the dangers of the arctic winter. Fate did not suffer Barents to return to his native land; he died in one of the small boats on June 20, 1597.

The notes collected and published by L'Honoré Naber in the second volume are especially complete and show the enthusiastic love of the author for the subject of his investigations. The cartographer interested in early European maps of the arctic regions finds much of value in the posthumous Barents map of 1598, a reproduction of which accompanies the second volume. Spitzbergen and Bear Island (T'veere Eylandt) are shown for the first time on this map.

THEODOOR DE BOOY

RASMUSSEN, KNUD. **Över Grönlands Inlandsis: Dagboksblad från "Den första Thule-expeditionen."** Translated from the Danish by Axel Nihlén. viii and 236 pp.; maps. P. A. Norstedt & Söners förlag, Stockholm, 1915. Kr. 2.50. 8 x 5.

The scientific results of Knud Rasmussen's sledge journey of 1912 across the broad northern expanse of Greenland's inland ice have been described in his "Report of the First Thule Expedition," which has been reviewed in an earlier number of the *Review* (Vol. 2, 1916, pp. 65-66).

The present volume contains a Swedish translation of the Danish original of Knud Rasmussen's daily journal on this trip, which was made, in the main, by means of what the author calls "Eskimo technique." Knud Rasmussen is a Greenlander of mixed blood. He has all the best qualities of the Eskimo, his patience, endurance, and good humor, his intimate knowledge of nature and capacity for frugal living. At the same time, he possesses the fire and vision of the Scandinavian combined with unusual literary ability. The book is well worth translating into English in its entirety.

HANNA ASTRUP LARSEN

LUNDAGER, ANDR. **Some notes concerning the vegetation of Germania Land, north-east Greenland.** Map, diagrs., ills. *Meddelelser om Grønland*, Vol. 43, 1917, pp. 349-414. Copenhagen.